



NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA

THESIS

**TECHNOLOGY STRATEGY IN IRREGULAR
WARFARE: HIGH-TECH VERSUS RIGHT-TECH**

by

Kevin P. Rowlette

December 2015

Thesis Advisor:
Second Reader:

Robert Burks
Ian Rice

Approved for public release; distribution is unlimited

THIS PAGE INTENTIONALLY LEFT BLANK

REPORT DOCUMENTATION PAGE			<i>Form Approved OMB No. 0704-0188</i>	
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instruction, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188) Washington, DC 20503.				
1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE December 2015	3. REPORT TYPE AND DATES COVERED Master's thesis	
4. TITLE AND SUBTITLE TECHNOLOGY STRATEGY IN IRREGULAR WARFARE: HIGH-TECH VERSUS RIGHT-TECH			5. FUNDING NUMBERS	
6. AUTHOR(S) Kevin P. Rowlette				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Postgraduate School Monterey, CA 93943-5000			8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING /MONITORING AGENCY NAME(S) AND ADDRESS(ES) N/A			10. SPONSORING/MONITORING AGENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government. IRB Protocol number ____ N/A ____.				
12a. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release; distribution is unlimited			12b. DISTRIBUTION CODE	
13. ABSTRACT (maximum 200 words) When faced with any type of irregular warfare, technology integration has proved to be problematic for developed countries with technologically advanced militaries. Developed countries train and equip their militaries and develop military doctrines that tend to focus on protection from other developed countries. Thus, these military agencies are well prepared for conventional warfare and assume they can use the same operational concepts against irregular adversaries as well. Unfortunately, this theory has proved incorrect. History suggests that developed countries rely on the most advanced technologies to provide an advantage in all operations; however, high-tech does not always equate to right-tech. Through three related case studies, this thesis analyzes how strong actors use varying levels of technology to engage weak actors in irregular warfare, and how the misuse of technology can lead to defeat rather than victory for the "strong" actors. I suggest that advanced militaries should develop technology strategies for irregular warfare that are based on tailored capabilities. Additionally, these agencies need processes that promote tactical and technological innovation to fill operational gaps in their capabilities for waging irregular warfare.				
14. SUBJECT TERMS Technology strategy, irregular warfare, unconventional warfare, high-tech, low-tech, special operations, Afghanistan, Britain, Soviet Union, United States, aircraft, artillery			15. NUMBER OF PAGES 147	
			16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT UU	

NSN 7540-01-280-5500

Standard Form 298 (Rev. 2-89)
Prescribed by ANSI Std. Z39-18

THIS PAGE INTENTIONALLY LEFT BLANK

Approved for public release; distribution is unlimited

**TECHNOLOGY STRATEGY IN IRREGULAR WARFARE: HIGH-TECH
VERSUS RIGHT-TECH**

Kevin P. Rowlette
Major, United States Air Force
B.S., Embry-Riddle Aeronautical University, 2002

Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN DEFENSE ANALYSIS

from the

**NAVAL POSTGRADUATE SCHOOL
December 2015**

Author: Kevin P. Rowlette

Approved by: Robert Burks, Ph.D.
Thesis Advisor

Ian Rice, COL, United States Army
Second Reader

John Arquilla, Ph.D.
Chair, Department of Defense Analysis

THIS PAGE INTENTIONALLY LEFT BLANK

ABSTRACT

When faced with any type of irregular warfare, technology integration has proved to be problematic for developed countries with technologically advanced militaries. Developed countries train and equip their militaries and develop military doctrines that tend to focus on protection from other developed countries. Thus, these military agencies are well prepared for conventional warfare and assume they can use the same operational concepts against irregular adversaries as well. Unfortunately, this theory has proved incorrect. History suggests that developed countries rely on the most advanced technologies to provide an advantage in all operations; however, high-tech does not always equate to right-tech. Through three related case studies, this thesis analyzes how strong actors use varying levels of technology to engage weak actors in irregular warfare, and how the misuse of technology can lead to defeat rather than victory for the “strong” actors. I suggest that advanced militaries should develop technology strategies for irregular warfare that are based on tailored capabilities. Additionally, these agencies need processes that promote tactical and technological innovation to fill operational gaps in their capabilities for waging irregular warfare.

THIS PAGE INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

I.	INTRODUCTION	1
A.	TECHNOLOGY STRATEGY	1
B.	SHIFTING STRATEGY	4
C.	RESEARCH QUESTION	7
D.	LITERATURE REVIEW	7
1.	Irregular Warfare and Technology	7
2.	Defining Irregular Warfare	9
3.	Technology Theory	11
4.	The Environment Matters.....	14
II.	APPROACH AND METHODOLOGY	17
A.	HYPOTHESIS.....	17
B.	DEFINING THE LEVELS OF TECHNOLOGY.....	18
C.	RESEARCH DESIGN	20
1.	Mission Type.....	21
2.	Mission Flexibility, Environment, and Required Support.....	22
D.	THESIS OVERVIEW	23
III.	IN-DEPTH CASE STUDY OF TECHNOLOGY STRATEGY IN THE THIRD BRITISH ANGLO-AFGHAN WAR	25
A.	END OF THE SECOND ANGLO-AFGHAN WAR	25
B.	GOING TO WAR	26
C.	DOCTRINE LIMITING RIGHT-TECH	28
1.	Artillery Doctrine.....	28
2.	Aviation Doctrine	29
D.	TECHNOLOGY USED ON THE BATTLEFIELD.....	30
1.	Artillery Technology	32
2.	Aircraft Technology.....	34
3.	Military Operational Integration	36
E.	TECHNOLOGY UTILIZATION EVALUATION	40
IV.	IN-DEPTH CASE STUDY OF TECHNOLOGY STRATEGY IN THE SOVIET UNION'S AFGHAN WAR	45
A.	THE SOVIET-AFGHAN RELATIONSHIP.....	46
B.	GOING TO WAR	47
C.	DOCTRINE LIMITING RIGHT-TECH	49
D.	TECHNOLOGY USED ON THE BATTLEFIELD.....	52
1.	Artillery Technology	55
2.	Aircraft Technology.....	57

3.	Military Operational Integration	60
E.	TECHNOLOGY UTILIZATION EVALUATION	66
V.	IN-DEPTH CASE STUDY OF TECHNOLOGY STRATEGY IN THE UNITED STATES-AFGHAN WAR	71
A.	AFGHANISTAN, THE TALIBAN, AND AL QAEDA.....	72
B.	GOING TO WAR	73
C.	DOCTRINE LIMITING RIGHT-TECH	75
D.	TECHNOLOGY USED ON THE BATTLEFIELD.....	76
1.	Artillery Technology	79
2.	Aircraft Technology.....	80
3.	Military Operational Integration	82
E.	TECHNOLOGY UTILIZATION EVALUATION	88
VI.	CONCLUSION	91
A.	CHANGES TO DOCTRINE	92
B.	CHANGES IN PROCESSES	93
1.	Change in Resource Allocation Processes.....	94
2.	Change in Tactical Analysis Processes.....	94
3.	Change in the Acquisitions Processes	96
C.	SUMMARY	97
APPENDIX A.	ARTILLERY	99
A.	THE MISSION IN IRREGULAR WARFARE	99
B.	ARTILLERY SPECIFICATIONS FROM THIRD ANGLO- AFGHAN WAR	103
C.	ARTILLERY SPECIFICATIONS: THE SOVIET UNION AFGHANISTAN INVASION.....	105
D.	ARTILLERY SPECIFICATIONS: UNITED STATES AFGHANISTAN CONFLICT.....	107
APPENDIX B.	AIRCRAFT	109
A.	THE MISSION IN IRREGULAR WARFARE	109
B.	AIRCRAFT SPECIFICATIONS FROM THIRD ANGLO- AFGHAN WAR	112
C.	AIRCRAFT SPECIFICATIONS: THE SOVIET UNION AFGHANISTAN INVASION.....	114
D.	AIRCRAFT SPECIFICATIONS: UNITED STATES IN AFGHANISTAN CONFLICT.....	116
LIST OF REFERENCES	119
INITIAL DISTRIBUTION LIST	129

LIST OF FIGURES

Figure 1.	DOD Interpretation of Irregular Warfare, What It Includes, and the Relationship with Special Operations.	11
-----------	---------------------------------------------------------------------------------------------------------------	----

THIS PAGE INTENTIONALLY LEFT BLANK

LIST OF TABLES

Table 1.	Detailed Information for the Artillery the British Empire Utilized in the Third Afghan-Anglo War.....	103
Table 2.	Weighted Artillery Capabilities Based on Commander's Priorities That May Have Existed during the Third Anglo-Afghan War	104
Table 3.	Detailed Information for All the Artillery the Soviet Union Utilized in This War	105
Table 4.	Weighted Artillery Capabilities Based on Commander's Priorities That May Have Existed during the Soviet Invasion of Afghanistan	106
Table 5.	Detailed Information for All the Artillery the United States Utilized in Afghanistan during the War on Terror	107
Table 6.	Weighted Artillery Capabilities Based on Commander's Priorities That May Have Existed During the United States Afghan Conflict.....	107
Table 7.	Detailed Information for All the Aircraft the British Empire Utilized in the Third Anglo-Afghan War	112
Table 8.	Weighted Aircraft Capabilities Based on Commander's Priorities That May Have Existed during the Third Anglo-Afghan War	113
Table 9.	Detailed Information for All the Aircraft the Soviet Union Utilized within This Afghanistan Conflict.....	114
Table 10.	Weighted Aircraft Capabilities Based on Commander's Priorities That May Have Existed during This Soviet Afghanistan Conflict.....	115
Table 11.	Detailed Information for Most of the Aircraft the United States Utilized within the Afghanistan Conflict.....	116
Table 12.	Weighted Aircraft Capabilities Based on Commander's Priorities That May Have Existed during the United States–Afghanistan Conflict	117

THIS PAGE INTENTIONALLY LEFT BLANK

LIST OF ACRONYMS AND ABBREVIATIONS

AAA	anti-aircraft artillery
AAG	Army Artillery Group
AFDD	Air Force Doctrine Document
ATACM	Army Tactical Missile System
AOR	area of responsibility
BL	breech loading
CAOC	Combined Air Operations Center
CAS	close air support
CIA	Central Intelligence Agency
DAG	Division Artillery Group
DOD	Department of Defense
DRA	Democratic Republic of Afghanistan
ECM	electronic countermeasure
FAB	Field Artillery Brigade
FDC	fire direction center
FOB	forward operating base
GWOT	Global War on Terror
HIMARS	High Mobility Artillery Rocket System
JTAR	Joint Tactical Air Request
LOC	lines of communication
MBRL	multiple barrel rocket launcher
MLRS	multiple launch rocket system
MPH	miles per hour
NATO	North Atlantic Treaty Organization
OSD	Office of the Secretary of Defense
PGM	precision guided munition
QF	quick fire
RA	Royal Army
RAF	Royal Air Force
RAG	Regimental Artillery Group

RFA	Royal Field Artillery
RFC	Royal Flying Corp
RG	Royal Garrison Artillery
RHA	Royal Field Artillery
RPG	rocket-propelled grenade launched
SA	surface to air
SAM	surface to air missile
SOCOM	Special Operations Command
TTP	tactics, techniques and procedures
U.S.	United States
USSR	Union of Soviet Socialist Republics
ZPU	Russian anti-aircraft machine gun mount

ACKNOWLEDGMENTS

The support of my professors, the writing center, and the thesis office has made this project possible. Professor Burks allowed me to pursue this topic in my own way, mentoring me along the way. He instilled confidence when needed, and mentored as I strayed off topic. COL Rice was also an influential force in this project. He encouraged all students to pursue a topic they were passionate about; his insistence on clarity, consistency, and format greatly contributed to the project at the most fundamental level. Throughout my time at the Naval Postgraduate School I have been fortunate to have the support of the faculty. Every class stimulated critical thinking, every professor inspired their students, and the subject core is at the heart of military issues facing many countries today. At home my astounding wife and wonderful children supported me throughout my time working on this thesis. Without Lee Ann this could have never happened.

THIS PAGE INTENTIONALLY LEFT BLANK

I. INTRODUCTION

In its 2001 transformation study report, the Office of the Secretary of Defense (OSD) called for a makeover of the Department of Defense's (DOD) "technology application . . . through which significant gains in operational effectiveness, operating efficiencies and cost reductions [could be] achieved."¹ The report concluded that the U.S. military was essentially stuck in an archaic, conventional mindset regarding the use of technology in warfare. The OSD called for effectiveness through a change in technology capability based on operational environment and efficiency to reduce resources or manpower without decreasing capability.² Yet, after more than a decade of the war on terror, the United States is still wrestling with the problem of properly employing the correct level of technology in irregular conflicts. National and operational strategies have yet to address the complexity of irregular warfare, and the use of weapons technology largely remains conventional. Over the past fourteen years, weapons employment has drastically changed as each military branch sought to modernize its force. This has translated into increases in advanced technology in an effort to limit collateral damage. However, this study argues that the improvements in technology have not actually increased capability or effectiveness but, only increased operating cost. Thus, technological considerations in strategy are needed to ensure there is an increase in capability and effectiveness as well. In other words, "right-tech" solutions in irregular warfare may prove more important than high-tech ones.

A. TECHNOLOGY STRATEGY

Throughout the campaign since 9/11, the United States has employed largely conventional strategies of engagement against irregular actors in Afghanistan and Iraq.³

¹ Office of the Secretary of Defense, *Transformation Study Report: Transforming Military Operational Capabilities* (Washington, DC: Government Printing Office (April 27, 2001), 5.

² United States Joint Chiefs of Staff, *Joint Pub 3-0: Doctrine for Joint Operations* (Washington, DC: United States Joint Chiefs of Staff, August 11, 2011). This publication defines effectiveness and the application of technology to increase effectiveness in the executive summary.

³ Thom Shanker and Eric Schmitt, "US Plans Shift to Elite Units as it Winds Down in Afghanistan," *New York Times*, February 4, 2012 <http://www.nytimes.com/2012/02/05/world/asia/us-plans-a-shift-to-elite-forces-in-afghanistan.html>.

This approach, as outlined in the U.S. national strategy and DOD publications, has driven the implementation and overuse of high-tech solutions.⁴ Prior to September 2001, both the DOD and the Bush administration focused on using technological improvements such as precision-guided munitions to destroy international terrorist organizations. True to its conventional strategy, the United States purchased the latest cutting-edge technology with the goal of gaining an immediate advantage over its opponents.⁵ However, the past fifteen years have demonstrated that the United States would not predominantly be dealing with a conventional enemy in the near term, highlighting the need to weigh conventional and irregular warfare considerations with regard to technological strategic approaches.

After four years of operating under a conventional strategy in an irregular conflict, the Bush administration updated the *National Security Strategy* in 2006, citing a lack of success on the battlefield as the reason for change.⁶ However, sophisticated and precision technology remained the principal means of defeating opponents, placing emphasis on the importance of using high-tech means in warfare.⁷ Following multiple years of military and technology surge strategies, in 2009 former Secretary of Defense Robert Gates assessed the United States' opponents' war-fighting strategy:

The categories of warfare are blurring and do not fit into neat, tidy boxes. We can expect to see more tools and tactics of destruction—from the sophisticated to the simple—being employed simultaneously in hybrid and more complex forms of warfare.⁸

⁴ George W. Bush, *The National Security Strategy of the United States of America* (Washington, DC: Executive Office of the President, 2002), 30.

⁵ Frank G. Hoffman, "Complex Irregular Warfare: The Next Revolution in Military Affairs," *Orbis* 50, no. 3 (2006): 396.

⁶ Barack Obama, *The National Security Strategy of the United States of America* (Washington, DC: Executive Office of the President, 2010), 1–9.

⁷ United States Joint Chiefs of Staff, *National Military Strategy of the United States of America: A Strategy for Today; a Vision for Tomorrow* (Washington, DC: Joint Chiefs of Staff, 2004).

⁸ Robert M. Gates, "Balanced Strategy: Reprogramming the Pentagon for a New Age," *Foreign Affairs*. January/February, 2009, 28. (accessed 1 June, 2015), <https://www.foreignaffairs.com/articles/united-states/2009-01-01/balanced-strategy>.

Yet, in 2010 the National Security strategy continues to emphasize technology development, and does not mention developing an effective technology strategy for this complex environment.⁹

Philip Towle recognized that “the struggle [of developing an effective irregular warfare strategy] revolves around technology to a greater extent than in the past.”¹⁰ He also suggests that strong actors will have a difficult time limiting their use of advanced technology in irregular warfare. Stephen Biddle also postulated that the “Expectations of a looming revolution in military affairs . . . could easily lead to an overemphasis on new technology . . . that could weaken, not strengthen, the American military.”¹¹ Biddle stressed the importance of a strong technology strategy and that systematic materials interlace through military development; however, he only applied his theory to conventional, large-scale warfare. Without a clear technology strategy in irregular warfare, strong actors will continue to overemphasize the importance of high-tech, and operate without the capabilities obtainable with right-tech.

Finally, according to John Arquilla, Friedrich August von der Heydte provided a more detailed difference between irregular and conventional warfare. Irregular warfare is a long, attritional conflict, whereas, the world wars aside, conventional conflicts are often short, with a single conclusive battle or campaign. Differing levels of technology are most effective in each type of conflict.¹² The United States has long been adjusted to square off against other nation-states, and has maintained a conventional and technological strategy as a result. The war on terror, and its irregular environment, forced the United States to rethink each step of their strategy and operational technology use. With this new conflict, it is equally important not only for technology to be strategically interlaced among the military force in irregular warfare as it is in conventional warfare,

⁹ Obama, *The National Security Strategy of the United States of America*, 2010.

¹⁰ Philip Anthony Towle, *Pilots and Rebels: The Use of Aircraft in Unconventional Warfare 1918–1988* (London, UK: Brassey's, 1989), 7.

¹¹ Stephen Biddle, *Military Power: Explaining Victory and Defeat in Modern Battle* (Princeton, NJ: Princeton University Press, 2010), ix.

¹² John Arquilla, *Insurgents, Raiders, and Bandits: How Masters of Irregular Warfare Have Shaped Our World* (Lanham, MD: Ivan R. Dee, 2011), 9.

but it must also be properly matched to and applied in each warfare scenario. Unfortunately, the DOD leaderships' continued tunnel vision focus on high-tech means over capability and effectiveness have failed to displace or defeat the irregular enemies within Afghanistan and Iraq. To make matters worse, those fighting against the United States have the opportunity to exploit these gaps in capability and effectiveness, giving them momentum and support for their cause.

Despite this knowledge and counsel, the U.S. DOD has continued to court technology giants such as Boeing and Lockheed for newer, high-tech solutions. Operational commanders have joined academic scholars against this course of action. Captain Robert Newson, former Naval Special Warfare strategy and concept commander, argued against continued high-tech solutions for such a low-tech enemy. He suggests the cost will be too great for prolonged irregular warfare using expensive high-tech weapon systems, while our enemies continue to see success through low-tech means.¹³ Using this high-tech strategy against a low-tech enemy has proved to be a complete failure. High-tech solutions have led to massive cost overruns and implementation delays, while ignoring the needs of the military forces brings the United States not a single step closer to ending the war on terror. These over-expenditures, multiplied over the course of a decade, have led to confined resource availability.¹⁴ Innovative use of lower technology offers a more proportional and cost-effective solution while maintaining an operational or asymmetric advantage.

B. SHIFTING STRATEGY

Following the attacks of September 2001, scholars studying irregular warfare advanced new theories on how developed nations—as the strong actors—should fight in irregular warfare. Many of these theories modify and update older ones, and they all attempt to outline the methods strong actors should follow to achieve success in irregular

¹³ Mark Pomerleau, "Special Forces: Why Use a Cadillac When a Ford Will Do," *Defense Systems Knowledge*, 27 May 2015. (accessed 15 June, 2015), <https://defensesystems.com/articles/2015/05/27/ussocom-budget-pressures-isr.aspx>.

¹⁴ Amy Belasco, *Cost of Iraq, Afghanistan, and Other Global War on Terror Operations Since 9/11* (CRS Report No. RL33110) (Washington, DC: Congressional Research Service, 2013), 2. <https://www.fas.org/sfp/crs/natsec/RL33110.pdf>.

warfare. Some scholars suggest simple changes to the national strategy and operational planning; others modify combat techniques, and a rare few attempt to completely re-structure the entire DOD.

Andrew Mack argued that popular and political will influence the outcome of irregular wars, often giving the weaker actors victory. Because conventional campaigns are typically short-term conflicts decided by decisive battle, strong actors should not depend on continued, long-term popular and political support. In irregular warfare theory, weak actors may focus on drawing the conflict out over an extended period of time. As time progresses, strong actors suffer from falling popular support, which contributes to lost political resolve and forces the strong actor to abandon its engagement.¹⁵ Thus, weak actors need only strive to “hold out,” rather than achieve victory through a decisive engagement. The misapplication of technology strategy gives weak actors a further advantage in irregular warfare, and reduces the strong actors’ overall capability.

Another irregular warfare theory advanced by Ivan Arreguín-Toft argues the weak win wars because of dissimilar strategies, noting that the weak actors’ commitment to the campaign nullifies the strong actors’ substantial power advantage.¹⁶ If a weak actor chooses an indirect method of conflict, the strong actor will stand the best chance of success by implementing a similar strategy, suggesting why the Global War on Terror (GWOT) campaign has failed. Jeffrey Record noted that assistance, whether direct or indirect, from external actors influences the outcome for the weak actor. External actors may offer resources, technology, training, or political support in the international community, all of which influence the weak actors’ ability to wage irregular campaigns. However, this support would not enable the weak to fight conventionally, or in a direct manner.¹⁷ Mack, Arreguín-Toft, and Record ultimately conclude that the weak sometimes defeat the strong due to some degree of asymmetry induced by the strong

¹⁵ Andrew Mack, “Why Big Nations Lose Small Wars: The Politics of Asymmetric Conflict,” *World Politics* 27, no. 02 (1975): 175–200.

¹⁶ Ivan Arreguin-Toft, “How the Weak Win Wars: A Theory of Asymmetric Conflict,” *International Security* 26, no. 1 (2001): 93–128.

¹⁷ Jeffrey Record, “Why the Strong Lose,” *Parameters, Winter* (2005): 16–31.

actors. Each argument focuses on removing the asymmetry, as a means to ensure continued resolve and support, enabling victory or enemy displacement.

Using the logic outlined by Mack, Arreguín-Toft, and Record, strong actors should seek to remove asymmetries of effort that weak actors can exploit to enable success. If the weak actor can exploit the asymmetry technology creates, the increased capability or effectiveness obtained by this technology is removed, and there is increased cost with no benefit. Since the DOD has consistently focused solely on high-tech means as outlined in the national strategy, it failed to heed Gates's recommendation of using technology that matches that of the enemy.¹⁸ By ignoring medium- and low-tech solutions and their potential for strategic integration, the United States has become part of the problem. The United States has created its own asymmetric "disadvantage" and thus given its opponents an unprecedented advantage in battle. This tunnel vision then impedes the success of an advanced military's strategy and campaign against an enemy.

Logic assumes that a strong actor looks for a power advantage over the weak; thus, this advantage would naturally become asymmetric. Strong actors such as the United States seek a power advantage over opponents through technological means. On the whole, advanced militaries believe they possess a higher capability and flexibility because of their technology, leading to a dangerous conclusion of instant superiority. This strategy, which emphasizes high-tech weaponry in irregular warfare, increases asymmetry between the strong and weak actors, but decreases both capability and effectiveness. This inverse results in a loss of a true technological advantage. The United States could utilize existing technology in an innovative manner if they: (1) reduced their dependency on high-tech; (2) sought to assimilate medium- and low-tech solutions into a thoughtful technology strategy; and (3) incorporated this strategy into a clear concise doctrine. These suggestions provide several advantages. Asymmetry of effort and cost are reduced, increased capability and effectiveness are achieved, and true asymmetry is attained by the strong actor.

¹⁸ Barack Obama, *The National Security Strategy of the United States of America* (2010), 2–9.

C. RESEARCH QUESTION

How should strong actors with technologically advanced militaries use varying levels of technology to engage a weak actor in irregular warfare? And in turn, do strong actors efficiently use their technological advantages in a manner that leads to success in an irregular warfare campaign? This question is drawn from operational experience where technologically advanced militaries throw their technological advantages at a problem versus developing a strategy that efficiently employs the technological advantages.

D. LITERATURE REVIEW

To examine the use of technology in irregular warfare and understand the benefits offered by most levels of technology, it is important to define the different types of technology, review existing theories of technology in warfare, and develop case studies of technology-based environments in irregular warfare. Scholars and leaders, particularly over the past century, have been analyzing the evolution of technology to properly define its role and effectiveness in warfare. Additionally, some scholars believe environmental conditions of a given situation may lead to the misapplication of technology, and their analysis of the environment is based on simplicity and stability.¹⁹ By understanding the difference between a simple and complex environment—and a stable and unstable environment—it is possible to determine the correct level of technology that could enable success in irregular warfare. This would give the United States the ability to induce the desired asymmetry, and increase capability and effectiveness.

1. Irregular Warfare and Technology

The U.S. Air Force has recognized a problem with its employment of advanced technology, as they have noted in their irregular warfare doctrine that “[irregular warfare] is about right-tech, not about high or low-tech.”²⁰ They have directed commanders to

¹⁹ These scholars include, but are not limited to, Biddle, Van Creveld, Boot, Rubright, and Wintringham all covered in the literature review.

²⁰ United States Air Force, *Air Force Doctrine Document 3-2, Irregular Warfare*. Washington DC: Department of the Air Force, March 15, 2013, 11.

look past high-tech for solutions at lower technological levels. However, the Air Force has not provided a method for its commanders to implement this guidance. This suggests the U.S. Air Force needs to develop a method for their commanders to properly use technology if the intent is for them to follow the doctrinal guidance of using right-tech. I would argue the DOD needs to address this strategic problem, not just the Air Force.

Three noted scholars suggested doctrine must be addressed to enable the technology transformation called for by the OSD. According to Richard Rubright, “Doctrine applied by military force is as important as the military devices themselves.”²¹ Moreover, Hone and Friedman postulate that any technology innovation is useless to the military components without a doctrine to exploit these advances or changes in technology. Additionally, this doctrine should be realized for building techniques and training to enhance technology employment capability and effectiveness.²² Although Air Force doctrine is the only one that addresses technology, its overly vague verbiage offers little assistance to commanders. Service doctrines must embrace a methodology to enable successful use of technology while increasing effectiveness and efficiency. This will prove to be problematic, as the DOD does not have a universally accepted definition of irregular warfare.

²¹ Richard W. Rubright, *The Role and Limitations of Technology in U.S. Counterinsurgency Warfare* (Lincoln, NE: Potomac Books, 2014), 18.

²² Thomas C. Hone and Norman Friedman, “Harnessing New Technologies,” in *Transforming America’s Military*, ed. Hans Binnendijk (Washington, DC: National Defense University, 2002), 31–36.

2. Defining Irregular Warfare

Scholars have battled unsuccessfully for years to iron out a clear, yet all-inclusive definition of “irregular warfare.” Additionally, the DOD does not have a universally accepted definition of irregular warfare. The U.S. Army and Air Force have updated their definition of irregular warfare to reflect that of *Joint Publication 1*.²³ The Navy, on the other hand, has yet to fully develop and publish their own definition of irregular warfare. If the Navy updated their doctrine to match that of the joint publication, this would be the first time all U.S. military branches unanimously shared the same definition, and may prevent the typical divergent reaction following a withdrawal from irregular warfare like that of the post-Vietnam era.²⁴ Understanding how the military of a nation-state interprets irregular warfare is crucial to identifying and introducing the right technology into the conflict, and preventing unwanted asymmetry. For this analysis, irregular warfare (see Figure 1) is defined as actors using other than conventional warfare methods, including

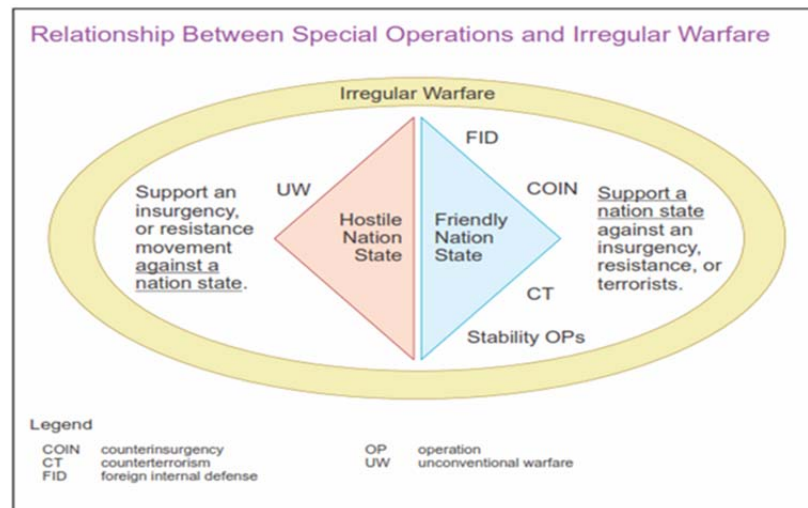
²³ United States Air Force, *Air Force Doctrine Document 3-2, Irregular Warfare* (Washington DC: Department of the Air Force, March 15, 2013); United States Army, *Army Doctrinal Reference Publication 3-05, Special Operations* (Washington DC: Department of the Army, August 31, 2012); Ronald O’Rourke, *Navy Irregular Warfare and Counterterrorism Operations: Background and Issues for Congress* (CRS Report No. RS22373) (Washington, DC: Congressional Research Service, 2015), <https://www.fas.org/sgp/crs/natsec/RS22373.pdf>.

²⁴ Andrew F. Krepinevich Jr., *The Army and Vietnam* (Baltimore, MD: JHU Press, 2009), 274–275.

low-intensity or periphery methods.²⁵ This interpretation of irregular warfare is lower in intensity than conventional warfare, but may have elements of conventional warfare in it. Understanding what irregular warfare is enables the discussion of technology, and its strategic use in irregular warfare.

²⁵ Colin S. Gray, *Explorations in Strategy* (Westport CT: Greenwood Publishing Group, 1996), 144–146. Colin Gray implies irregular warfare encompasses a low-intensity conflict, which includes guerrilla and counter guerrilla warfare, or any operation that takes place in the periphery. Colin S. Gray, “Irregular Warfare: One Nature, Many Characters,” *Strategic Studies*, Winter (2007): 37. Gray updated his definition to include insurgency and terrorism; Hoffman, *Complex Irregular Warfare: The Next Revolution in Military Affairs*, 396. Hoffman postulates that it is “nontraditional modes of warfare that are causing violent perturbations to the existing world order,” and it is becoming a new form of warfare altogether.; David Kilcullen, “Complex Irregular Warfare: The Face of Contemporary Conflict,” *The Military Balance* 105, no. 1 (2005): 412. David Kilcullen defines irregular warfare as “warfare involving non-state actors or non-traditional methods”; Martin Van Creveld, *Technology and War: From 2000 BC to the Present* (New York, NY: The Free Press, 1991), 299. Martin Van Creveld defines irregular warfare as “subconventional warfare . . . known as insurgency, terrorism, and guerrilla warfare”; Friedrich August von der Heydte and George Gregory, *Modern Irregular Warfare: In Defense Policy and as a Military Phenomenon* (New York, NY: New Benjamin Franklin House, 1986), 3. Von der Heydte defines irregular warfare as “armed conflict, in which the parties are not large units, but small . . . in which the outcome is . . . achieved in a large number of small, individual operations”; United States Joint Chiefs of Staff, *Joint Publication 3-05, Special Operations*. Washington, DC: United States Joint Chiefs of Staff. July 16, 2014a, II-10. The United States Department of Defense has recently revised their doctrine to define irregular warfare (see figure II-1) as warfare that may include: Foreign Internal Defense (FID); Counterinsurgency (COIN); Counterterrorism (CT); Unconventional Warfare (UW); or Stability Operations. FID is defined as “US activities that support a Host Nation’s internal defense and development (IDAD) strategy and program designed to protect against subversion, lawlessness, insurgency, terrorism, and other threats to their internal security, and stability,” and UW as “operations and activities that are conducted to enable a resistance movement or insurgency to coerce, disrupt, or overthrow a government or occupying power by operating through or with an underground, auxiliary, and guerrilla force in a denied area.” Counterterrorism is defined as “activities and operations taken to neutralize terrorists and their networks in order to render them incapable of using unlawful violence to instill fear and coerce governments or societies to achieve their goals” and the “primary role in security operations is to support the reform, restructure, or reestablishment of the HN armed forces and the defense aspect of the security sector.” Finally, counterinsurgency is a “comprehensive civilian and military effort designed to simultaneously defeat and contain insurgency and address its root causes.” Figure II-1, Relationship between Special Operations and Irregular Warfare; United States Joint Chiefs of Staff, *Joint Publication 1, Doctrine for the Armed Forces of the United States*. Washington, DC: United States Joint Chiefs of Staff. March 25, 2013, I-6. Irregular warfare is characterized as a violent struggle among state and non-state actors for legitimacy and influence over the relevant populations.

Figure 1. DOD Interpretation of Irregular Warfare, What It Includes, and the Relationship with Special Operations.



U.S. Joint Chiefs of Staff, *Joint Publication 3-30, Command and Control of Air Operations*. Washington, DC: U.S. Joint Chiefs of Staff. February 10, 2014b, II-2.

3. Technology Theory

Frank Hoffman points out how the misapplication of technology in irregular conflict can affect a strong actor's chances of success, citing the war on terror as an example. Hoffman accurately identifies the United States' need to evaluate the use of technology in irregular warfare. He highlights the need for technologically advanced militaries to change the ways they wage war, noting the future use of irregular tactics by weak actors will seek to avoid the overpowering conventional military supremacy like that of the United States. Hoffman argues the blending of warfare conducted by weak actors adds a new level of complexity, and strong actors have failed to select and apply the correct level of technology due to this complexity.²⁶

David Kilcullen asserts, "Armed forces today must deal with many adversaries beyond their traditional opponents, the regular armed forces of nation states . . . [t]his creates a multilateral and ambiguous environment, leading to vastly increased

²⁶ Frank G. Hoffman, *Conflict in the 21st Century: The Rise of Hybrid Wars* (Arlington, VA: Potomac Institute for Policy Studies, 2007), 8.

complexity.”²⁷ Martin van Creveld argues, “The simpler the environment in which war is waged the greater the advantages offered by high technology.”²⁸ He also notes the technology introduced by an external actor that is used by the weak actor must be simple due to environmental complexity.²⁹ Thus, technology has the potential to affect all modes of warfare based on environmental complexity. Finally, according to Richard Rubright, “Integration of technology into a force structure can come at the cost of strategic thought and a tendency to ignore complex issues.”³⁰ Technology, potentially, impacts the harmony between the different modes of warfare by steering strategy. In other words, strategy along with technology utilization shapes the environmental complexity, and if they are not in harmony with each other the technology capability may be reduced while increasing the environmental complexity.

For strategists and commanders to employ technology effectively, they need to understand the environmental issues that these scholars have mentioned, and how a weak actor can take advantage of the environment and the perceived asymmetric advantage. Richard Daft explains that environmental complexity goes beyond the physical location; it is also the rate of change and the level of uncertainty in association with risk. Daft also suggests that many elements of the environment are uncontrollable; however, simplified structure and resource allocation can enable operating in a complex or unstable environment.³¹ According to Lawrence and Dyer, an organization needs to adapt to environmental complexity through the mechanisms that interact with the environment.³² This suggests strong actors do not need to reorganize; rather, they need to change how they use their resources.

²⁷ Kilcullen, *Complex Irregular Warfare: The Face of Contemporary Conflict*, 413.

²⁸ Martin van Creveld, *Technology and War: From 2000 BC to the Present* (New York, NY: The Free Press, 1991), 272.

²⁹ Ibid., 300–310.

³⁰ Rubright, *The Role and Limitations of Technology in U.S. Counterinsurgency Warfare*, 17.

³¹ Richard Daft, *Organization Theory and Design* (Mason, OH: Cengage learning, 2012), 162–166.

³² Paul R. Lawrence, Davis Dyer, and Tom Lupton, “Renewing American Industry,” *R&D Management* 18, no. 1 (1988): 45–54.

Van Creveld argues that conventional warfare takes place in a simpler, more stable environment than irregular warfare. His assertion about technology in warfare suggests the technologically advanced militaries need to consider the appropriate use of technology in irregular warfare, and the implications of its use from the political to the tactical based on environment. Tom Wintringham noted the ineffectiveness of technology when one's enemy used guerrilla tactics during World War II. Strong actors at the time tried to apply the same technology to all modes of warfare. Wintringham points out its limitations, and suggests simpler machines might be more effective in this environment.³³ However, the United States and its allies seem to be embracing the same historical use of technology in the current war on terror, as if they are still fighting a conventional war. Following the logic outlined by Van Creveld and Wintringham, strong actors should reduce the level of technology employed in irregular warfare to match, or to slightly overmatch that of their enemies and limit the introduction of new technologies based on environmental complexity.

On the other hand, Rubright argues combining all levels of existing technologies will enable the military to provide new capabilities.³⁴ This would prevent the removal of the anticipated technological advantage a strong actor would expect. Thus, the best response should have the strong actor strategically apply all levels of technology where it can be most effective to increase the operational capability, and induce desired asymmetry while maintaining harmony of integration. However, he further argues new revolutionary technology is needed in irregular warfare to enable success.³⁵ On the surface, it looks like Rubright contradicts himself with this assertion. The issue is how he defines technology level. He does not spend much time explaining his understanding of what is high-, medium-, and low-tech. For example, Rubright proposes that precision guided munitions (PMGs) and the Specter gunship are on the same technological level; however, under the definitions I have outlined in this analysis, PGMs are high-tech and

³³ Tom Wintringham, *The Story of Weapons and Tactics from Troy to Stalingrad* (Boston MA: Houghton Mifflin Company, 1971), 207–230.

³⁴ Richard W. Rubright, *The Role and Limitations of Technology in U.S. Counterinsurgency Warfare* (Lincoln, NE: Potomac Books, 2014), 139.

³⁵ *Ibid.*, 139.

the AC-130H is medium-tech. Lastly, while he does argue technology upgrades are needed for irregular warfare, he continually stresses the need for harmony between technology integration and force development.³⁶

4. The Environment Matters

It has been argued that navies, operating in open water, fight in a simple environment.³⁷ However, strong navies, like that of the U.S., are using all levels of technology that have complicated the environment, potentially making the environment more complex and unstable. The German U-boats in World War II used a low-tech solution to develop snorkels, allowing them to stay submerged for long periods of time. The U-boats, assisted by the snorkels, complicated the environment for an open water navy, forcing navies to counter neatly masked subsurface threats as well as those traditionally silhouetted against the horizon on the surface. The revolutionary use of the snorkel resulted in an increased complexity of naval warfare.³⁸ Additionally, it is clear that a navy operating at sea is no longer operating in a one-dimensional environment. Submarines and aircraft have changed the environment; it is more complex and unstable for a modern navy that needs to consider a three dimensional environment. This is a good example of technology affecting the environment.

Van Creveld further argues the simplicity of the air environment.³⁹ However, without all the details one does not fully understand the environment. What were the political implications of this incident? To the lay observer, the Doolittle raid was a simple brazen use of flying technology to strike at the heart of the Japanese identity of invincibility. However, the operating environment was complicated due to the way Doolittle's unit used its available technology. The unit launched large heavy aircraft, traditionally land based, from an aircraft carrier designed for much smaller aircraft. Both the aircraft and aircraft carrier were nothing especially technological advanced given the

³⁶ Rubright, *The Role and Limitations of Technology in U.S. Counterinsurgency*.

³⁷ Van Creveld, *Technology and War: From 2000 BC to the Present*, 272–275.

³⁸ Eberhard Rössler, *The U-Boat: The Evolution and Technical History of German Submarines* (Annapolis, MD: Naval Inst Press, 1981).

³⁹ Van Creveld, *Technology and War: From 2000 BC to the Present*, 272–275.

time, but the combination of the two technologies was revolutionary in nature to meet specific strategic and political benefits that far outweighed the immediate tactical success.⁴⁰

Finally, Wintringham notes the ineffectiveness of tank units as they faced guerrilla fighters in urban environments during World War II. He argues the asymmetry created by the guerrillas, and the complexity of using the tanks in this environment put unsupported tank units at a disadvantage. The tanks were more susceptible to anti-tank weapons, and did not have the fast repeatable weaponry like machineguns carried by infantry necessary to eliminate this elusive threat; additionally, Rubright suggests that “Attractive new technical systems run the risk of emphasizing what the system can do rather than emphasizing what their shortcomings are when used outside a very narrow niche.”⁴¹ The tank was very much a new technology and was revolutionary in nature. Its use changed the way warfare was waged however the tank did not fare well in this environment because the guerrilla actually had the asymmetric advantage. She could remain hard to see while delivering devastating short-range against tank units restricted to the urban caverns with little room to maneuver.⁴² This is a good example of how a technology-based asymmetry in military capabilities can be used by a weaker actor to exploit her capability gaps.

In conclusion, technology is used extensively throughout warfare to create asymmetric advantage for one actor to impose his will over another. However, when technological advantages are employed in irregular warfare environments, multiple scholars have argued asymmetry potentially gives the weak actor the advantage over the strong actor in irregular warfare. Because the weak do not have the capability to face strong actors conventionally, they complicate the environment by operating when and where they choose, with weapons that attack weaknesses of the strong and in a manner that leaves them often invisible to a stronger actor.

⁴⁰ Paolo E. Coletta, “Launching the Doolittle Raid on Japan, April 18, 1942,” *Pacific Historical Review* (1993), 73–86.

⁴¹ Rubright, “The Role and Limitations of Technology in U.S. Counterinsurgency Warfare,” 18.

⁴² Wintringham, *The Story of Weapons and Tactics from Troy to Stalingrad*, 226–228.

THIS PAGE INTENTIONALLY LEFT BLANK

II. APPROACH AND METHODOLOGY

Regardless of the country in question, militaries are generally organized, trained, and equipped to fight against like organizations in what is commonly described as conventional warfare. However, during irregular conflicts, where an opponent does not have the same capabilities, organized militaries do not adjust to their opponents and employ their technological advantages in a manner that would be best used against a different type of enemy. In particular during irregular conflicts, technologically advanced militaries actually perceive their advantage as a panacea to defeat what is already a technologically weaker opponent. In doing so, technologically advanced militaries create a disadvantage when they inappropriately apply technology without considering the enemy as an important factor as to what is best used.

A. HYPOTHESIS

To test this claim, it should be apparent that if militaries during irregular warfare use their technological advantage appropriately then we should see a technological solution appropriately applied to a specific enemy-related tactical problem. For example, we should see aircraft designed for close air support being used in the role of close air support as opposed to a strategic bomber with advanced stealth capabilities being used inappropriately in the role of close air support directly impacting ground combat. This is not limited to the use of aircraft technologies. We should also see appropriate use of ground-tactical combat systems technologies. For example, the advances in artillery in the 20th century have been significant.⁴³ If militaries are using their artillery systems appropriately, then we should see evidence of decisions being made to employ the correct type of artillery against targets that they can achieve the best effects. In irregular warfare, this may mean lighter artillery pieces that can move through canalized terrain or may

⁴³ Dale Clarke, *British Artillery 1914–19: Field Army Artillery*, Vol. 94 (Oxford, Osprey Publishing, 2004). Andrew W. Hull, David R. Markov, and Steve Zaloga, *Soviet/Russian Armor and Artillery Design Practices: 1945 to Present* (Detroit, MI: Darlington Productions, 1999). Federation of American Scientists, “FAS Military Analysis Network U.S. Land Warfare Systems,” (accessed Aug 13, 2015), <http://fas.org/man/dod-101/sys/land/>.

require the ability to shoot at high angles in mountainous terrain in addition to being easily repaired in the field due to limited resupply and available maintenance.

B. DEFINING THE LEVELS OF TECHNOLOGY

Since different militaries have varying access to technology, each will have a different interpretation of what is the employment of high-tech and low-tech solutions to fight irregular opponents. Additionally, technology gradually permeates throughout all aspects of society, thus, the technological level is also dependent on the period examined. To bridge this gap, it is important to establish standard definitions. For this study, technology is divided into three categories: high, medium, and low.⁴⁴ High-tech is considered cutting edge or revolutionary for its time and would be the most advanced technology available to a military organization. Low-tech is an established and understood capability that individuals can comprehend and generally employ with minimal technical assistance specific to a period of time. Medium-tech weapons' systems

⁴⁴ When exploring the possibility of integrating technology strategy into doctrine as suggested, one needs to understand the variations in technology. While examining the technology theories throughout the literature review, multiple scholars categorized technology as revolutionary, evolutionary, and proliferated respectively.

Van Crevelde, *Technology and War: From 2000 BC to the Present*, 285–300. Evolutionary technology is characterized as a process of continual refinement through a series of incremental changes directed at improving capability or effectiveness. This is the majority of military technological history. Evolutionary technology is embedded in the organizational structure, from training to the battlefield, as the organization seeks to improve its technology effectiveness through efficiency. This evolution does not question the technologies ability to renders a decisive advantage.

Max Boot, *War Made New: Technology, Warfare, and the Course of History, 1500 to Today* (New York NY: Gotham Books, 2006) 6–8. When military technology transforms every aspect of warfare, then it is revolutionary in nature. This may occur from a single significant innovation in technology, or from multiple mutually supporting technology innovations. In other words, revolutionary technology has the potential to change every aspect of warfare, from the political to the tactical, and all the organizational structures that go with it.

Keith L. Carter, "Technology Strategy Integration" (Master's thesis, Naval Postgraduate School, 2012). Proliferated technology is generally available to all actors; however, each actor may utilize the technology differently through innovation. Additionally, when resources are constrained, it may help to adopt a strategy to capitalize on the widespread proliferation of technology in general.

The problem with these technology definitions within technology theory and the understanding of technology integration in irregular warfare is due to the drastic differences in technology use between strong and weak actor opponents. These definitions account for changes in time period and environments; however, they do account for the military's, or guerrilla fighters that use them. Once a revolutionary technology exists, it is revolutionary for all actors regardless if they have access to it. The definitions I outlined allow the reader to see what high-tech through low-tech is for both actors simultaneously, and understand they may be different technologies for the same time period.

for this study are those technologies that skillfully blend available high and low technologies to deliver an effective capability.

High-tech solutions are generally characterized as any new technologies that change, or revolutionize, warfare. Max Boot postulated that technology, “which spread[s] from one area to another, transform[s] everything.”⁴⁵ Boot used PGMs as an example of revolutionary technology. PGMs are undeniably revolutionary high-tech weapons. Precision guided munitions may have revolutionized the way the United States military employed its assets both offensively and defensively. During World War II, the inaccuracy of strategic bombing munitions forced the Army Air Corps to allocate large amounts of resources to attack and eliminate individual targets. This resulted in higher costs throughout the supply and operational chains. The invention of technologies that could be used to employ PGMs, modern U.S. air power can now task single aircraft to destroy any given target. Though high-tech solutions provide an advantage in warfare; these technologies are often incredibly difficult to employ in irregular warfare due to complex engagement requirements that potentially degrade the capability since the weapons system cannot often be employed as intended.

Low-tech solutions are readily available to all actors; yet, each actor may utilize the technology differently through innovation, based on location, supply chain availability, and mission effectiveness. Low-level technology solutions are extremely useful when resources are constrained as often the case with weak actors. As a 21st century example, prepaid tri-band cell phones are commonly used by insurgent groups today because of their ease of acquisition and now its common technologies. For an organization with limited infrastructure, the cell phone may be the primary means of communication as opposed to an actor with greater resources who may use the cell phone as a secondary or tertiary form of communication.

Examples of medium-tech weapons systems include single platform examples such as the AC-130 gunship and tanks, which provide a blended solution between low- and high-level technologies. The AC-130 has evolved over time to meet the needs of the

⁴⁵ Boot, *War Made New: Technology, Warfare, and the Course of History, 1500 to Today* Penguin, 8.

changing battlefield and the answer the call for more effective and efficient use of this very limited resource. By utilizing high-tech sensors and low-tech guns, the AC-130 can provide a decisive advantage in a number of scenarios in a cost effective manner.⁴⁶ The AC-130 model of blending technologies to meet a specific niche need is an exemplar of how technologies are continually refined to create a capability.

As another example, the tank has evolved over the course of both world wars and most notably during the 45-year Cold War. Technological improvements provided several advantages. Advances in metallurgy led to the development of new high-tech alloys which in turn led to the employment of thinner, stronger, and lighter armor. All designed to improve survivability while not sacrificing maneuverability.⁴⁷ The continual adaptation of high and low technologies together helps illustrate this middle category of weapons' technologies used in this study.

C. RESEARCH DESIGN

This study utilizes a heuristic approach to address the role of technology during irregular warfare. This qualitative approach illuminates possible technology integration strategies in irregular warfare through historical cases. This research focuses on identifying the proper use of technology in irregular warfare by examining the impacts of doctrine and on-the-ground decisions related to the use of technology. Accompanying the case study approach, an in-depth technical examination of artillery and aircraft utilized during each conflict studied offers insights into how technology influenced the decision to employ certain equipment over others to counter irregular opponents.

In order to examine the effectiveness of technology in operations to counter irregular opponents, this study compares three different conflicts in Afghanistan since 1919. Each case illustrates a different prominent actor's use of technology to fight an

⁴⁶ William P. Head, *Night Hunters: The AC-130s and Their Role in U.S. Airpower* (College Station, TX: Texas A&M University Press, 2014). Van Creveld, *Technology and War: From 2000 BC to the Present*.

⁴⁷ Bo Carlsson, "The evolution of manufacturing technology and its impact on industrial structure: an international study," *Small Business Economics* 1, no. 1 (1989), 21-37. Seth W. Carus, "Military technology and the arms trade: changes and their impact." *Annals of the American Academy of Political and Social Science* (1994), 163-174.

asymmetrically disadvantaged Afghan opponent. The first case is the Third Anglo-Afghan War (1919) fought between the British and the Afghans. The second is the Soviet occupation and fight against Afghan Mujahedeen (1979-1989). The final case is the United States-led campaign in Afghanistan (2001-2014).

By keeping the terrain of Afghanistan and a common enemy (the Afghan mujahedin fighter) as constants across all three cases, the research design allows three different actors to generally employ their respective military technologies and doctrine under the same circumstances. The differences across the actors then helps illuminate how very different actors make similar decisions in regards to employing types of military technology under like circumstances.

This design affords for variation across three different actors as well as technology across three different time periods. All three strong actors were technologically advanced for their period and were similarly organized military forces; yet, each actor has a distinct military doctrine of its own. First, the British doctrine is based on their World War I experience fighting trench warfare, and as such their tactics and use of technology represent this even though the British had vast experience conducting colonial warfare. Second, the Soviet experience in Afghanistan mirrors their formations and preparations for fighting in the plains of Western Europe. The Soviets chose to use a plethora of armored vehicles, artillery support groups, and a variety of supporting aircraft that are more suitable against NATO's mechanized formations. Finally, the United States, though it started the war with an unconventional invasion using small special operations forces teams and Afghan mujahedin counterparts as part of the Northern alliance, the conflict quickly became dominated by U.S. conventional forces with larger bases, armored vehicles albeit small ones, and supporting artillery typically limited to base use and base defense. Simply put, each military examined was designed to fight militaries similar to itself and not a guerrilla force.

1. Mission Type

A successful military campaign requires senior leaders and strategists to examine current doctrine, mission priorities, and available assets with their associated capabilities

in order to formulate a comprehensive campaign strategy based on mission type. According to recent U.S. Army doctrine combat systems and support of ground operations support three general types of operations: offensive, defensive, and shaping.⁴⁸ These three types of operations then lead to specific methods of employment of each combat system. The focus in this study is not so much the types of the operations, but more importantly, how the combat system is employed within each type of operation against an irregular enemy such as the Afghan mujahedin.

Shaping operations encompass all operations that set the stage for the campaign. Examples include reconnaissance, massing troops and equipment, preemptive air strikes, and artillery bombardment. Defensive operations have a twofold purpose: to defend captured territory against enemy attacks through economy of force, and to provide a stronghold for use as a base of operations in the field. Offensive operations are intended to defeat the enemy through the use of resources available to leaders. Each of these missions works in conjunction with the others.⁴⁹ The distinctions between these three types of operations are important because the specific effect needed in support of these operations determines the manner in which combat systems are employed. For example artillery fire in support of defensive or shaping operations do not need to be as accurate as artillery fire in support of offense of operations. This is mainly because in offensive operations it is assumed friendly ground forces will be advancing on the enemy. Under defensive or shaping scenarios generally we expect fire to be concentrated on enemy formations approaching friendly ground forces

2. Mission Flexibility, Environment, and Required Support

This research looks at factors focused on technology and its effectiveness, building an analytical framework based on the mission types outlined above while

⁴⁸ United States Joint Chiefs of Staff, *Joint Publication 1, Doctrine for the Armed Forces of the United States*. (Washington, DC: United States Joint Chiefs of Staff, March 25, 2013), I-7. United States Army, *Army Doctrine Reference Publication 3-0, Unified Land Operations* (Washington DC: Department of the Army, May 16, 2012). ADRP 3-0 offers a broader understanding of these three types of operation, and the Joint Pub links them to IW.

⁴⁹ United States Army, *Army Special Operations Forces* (FM 3-05) (Washington DC: Department of the Army, 2014a), 1–3.

considering three variables for technology strategy in irregular warfare. These variables include: mission flexibility, the operational environment, and the required system maintenance or support. First, examining the combat system flexibility, or multi-purpose capability of a technology utilized will highlight the adaptability and innovation afforded to the operators in this type of dynamic warfare. Second, the operational environment will determine some of the required technological capabilities, and examining the technology utilized based on this variable will illustrate operational limitations. Finally, irregular warfare is generally a limited war; thus, the support for employed combat systems may also be limited.

D. THESIS OVERVIEW

The study proceeds accordingly. Chapters III, IV and V are each an in-depth case studies that examine how a prominent military power has employed technology against a technologically disadvantaged opponent. Each case study briefly reviews the historical, doctrinal, and political origins of each conflict. As Rubright states “[t]he military capability directly dictate the military options available to policy makers”; thus, this influences technology strategy through political narrative and doctrinal changes.⁵⁰ Furthermore, each case analyzes the technology and strategy employed during each conflict with special emphasis given to a review of the use of key military capabilities, their e effectiveness when compared to other combat systems available. Chapter VI presents a summation of findings, as well as recommendations for engaging in further irregular conflicts. The two appendices cover all the technical information for each case study. Appendix A covers: modern doctrine and mission responsibility for artillery, illustrates the commanders decision matrix, provides an in-depth technical examination based on capabilities, and explains the findings for each case study. Appendix B covers the same information, only focused on aircraft.

⁵⁰ Rubright, *The Role and Limitations of Technology in U.S. Counterinsurgency Warfare*, 17.

THIS PAGE INTENTIONALLY LEFT BLANK

III. IN-DEPTH CASE STUDY OF TECHNOLOGY STRATEGY IN THE THIRD BRITISH ANGLO-AFGHAN WAR

The British Empire went to war with Afghanistan three different times prior to World War II; however, the Third Anglo-Afghan war, in 1919, was the only one of the three to include airpower and a modern mechanized ground force developed for large conventional warfare. The British military doctrine, technology employment, and general operating structure were heavily influenced by World War I, changing their method of warfare all together from previous irregular conflicts that were the hallmark of the British Empires “small wars” of the 18th and 19th centuries. On the surface, the Third Anglo-Afghan War appeared to be a conventional state versus state conflict; however, the strength of the Afghan people comes from tribal guerrilla fighters, and not a state-sponsored military. The British government was well aware of the guerrilla threat in Afghanistan; yet, chose to fight this war in a conventional manner.⁵¹ This would prove costly as the British Indian military would be challenged beyond their capability when facing the Afghan guerrilla fighters compared to their actions against conventionally arrayed Afghan military units.

A. END OF THE SECOND ANGLO-AFGHAN WAR

In 1880, the treaty ending the Second Anglo-Afghan War led to Afghan dependency on the British Empire, and the British mostly conducted all their activity with Afghanistan through their Indian colony. This treaty established a British political office in Kabul, and dictated that the Afghan government would turn to British India for all foreign policy activity and intra-government tutelage. Over the next forty years, the relationship between Afghanistan and Britain remained fairly stable; however, this relationship fractured during World War I. Afghanistan remained neutral in World War I. Though Afghanistan did not fight when the Ottoman Empire called for a Jihad against its enemies, they also refused to help Britain against the Ottomans.⁵² This led to much unrest

⁵¹ Edgar O’Ballance, *Afghan Wars 1839–1992: What Britain Gave Up and the Soviet Union Lost* (Herndon, VA: Brassey, 1993).

⁵² *Ibid.*, 50–51.

in Afghanistan as a predominantly Muslim tribal based society. Prior to World War I, tribal leaders did not push back against the central government with regard to British influence; however, their faith required them to answer the call for Jihad from the Ottoman Empire. When the Shah elected to ignore the call for Jihad, the tribal leaders within Afghanistan became enraged as this was against their faith. The tribal leaders carried more influence with the local tribes than the Shah, and when the British tried to reestablish their control in the region following World War I these tribal leaders demanded action toward independence.

In 1919, the Shah attempted to gain international recognition by seeking a seat at the Versailles Peace Conference. The Shah's request was denied, and shortly after, the population of Afghanistan continued to demand independence. When Shah Habibullah did not seek additional measures to push out British influence, he was assassinated. The new Shah, Amanulla Khan, called for quick action and demanded Afghanistan's independence. Amanulla Khan knew that this would ensure the people of Afghanistan would support his claim as the rightful successor of Habibullah. Additionally, Amanulla Khan gave the military members of Afghanistan a significant raise, ensuring their loyalty. With the military's support, the new Shah was able to arrest multiple individuals who were seen to threaten his claim as the rightful successor. With his throne secured, Amanulla Khan sent a letter to the British Empire in early March 1919, and for the first time spoke of an independent Afghanistan.⁵³

B. GOING TO WAR

In early April 1919, Shah Amanulla Khan gave a speech to the people of Afghanistan that clearly reinforced his desires for an independent Afghanistan. According to one British agent, the speech went as follows:

I have declared myself and my country entirely free, autonomous and independent both internally and externally. My country will hereafter be as independent a state as the other states and powers of the world are. No foreign power will be allowed

⁵³ Arnold Fletcher, *Afghanistan: Highway of Conquest* (Ithaca, NY, Cornell, 1965), 185–187. Ludwig W. Adamec, *Afghanistan, 1900–1923: A Diplomatic History* (Berkeley, CA: University of California Press, 1967), 108–110.

to have a hairsbreadth of right to interfere internally and externally with the affairs of Afghanistan.⁵⁴

Another British agent, Lord Chelmsford, felt that the new Shah should be able to renegotiate to some degree, as this had been done in the past; however, Lord Chelmsford chose to largely ignore the Shah's request. It became clear that Britain was tired of war as the country continued to seek political resolve, but continually fails to grant the independence Amanulla Khan demanded. To their dismay, the Shah continued to press the issue, and in early May he called for military action.

The political reaction from British India, following the arrival of Afghan military troops on its western border, was still lackadaisical, with no military action or mobilization. Three potential reasons existed for this lack of response: the British people were tired of war, they had exhausted their resources, or they were preoccupied with other issues such as an uprising in British India. All three reasons have been suggested as overarching evidence to why the British did not react militarily to the new Shah's actions; unfortunately, before mid-May these countries would be at war.⁵⁵ The British military of 1919 existed in a society that was largely anti-war, and military leaders found themselves operating in a resource-deprived environment.⁵⁶ The political and military interaction for the British Empire was divided, where the Afghan populace and military was clearly supporting their political leaders. Additionally, the British military forces in India, compared to British India pre-World War I, were much less prepared for war due to troop and the supply depletion it caused. Prior to World War I, the British Indian military had over 60 regiments, but following the war it had only ten; additionally, as Shah Khan threatened war, the British military was going through a mass demobilization.⁵⁷ In summary, the people in Britain did not have the will for another war, much less a long protracted war in Afghanistan; however, their military forces were still far superior to that

⁵⁴ Adamec, *Afghanistan, 1900–1923: A Diplomatic History*, 110.

⁵⁵ Fletcher, *Afghanistan: Highway of Conquest*, 187–189.

⁵⁶ Williamson R. Murray and Allan R. Millett, *Military Innovation in the Interwar Period* (New York, NY: Cambridge University Press, 1998), 9.

⁵⁷ Basil Perronet Hughes, *History of the Royal Regiment of Artillery: Between the Wars, 1919–1939* (Brassey, UK: the Royal Artillery Institution, 1992), 125.

of the Afghan military, and this leads the British to expect a quick victory. As the war unfolded over the next four months, this proved to be a false assumption.

C. DOCTRINE LIMITING RIGHT-TECH

Changes to doctrine often come from innovation, revolution, or evolution. While this change may help in current conflicts, it also hampers future innovation and operations for both British artillery and aviation. The British artillery and aviation communities were greatly affected by World War I. Prior to that war, British artillery was split among three different organizations of the Royal Army: the Royal Horse Artillery (RHA), the Royal Field Artillery (RFA), and the Royal Garrison Artillery (RGA) of which, the RHA was the dominant organization. The mechanization and employment methods developed during World War I led the RFA to become the dominant organization during World War I, and changed the missions for all three thereafter.⁵⁸ As a technology with only a handful of years of combat service, aviation also struggled to find an effective mission because of indecisive air operations in World War I. This would be seen in the mountains of Afghanistan as employment methods did not initially prove very useful for either the artillery or aviation.

1. Artillery Doctrine

Following World War I, artillery employment doctrine was very different for each artillery organization. Prior to World War I, RFA was primarily employed during shaping and offensive operations. RHA organizations employed light, highly mobile artillery pieces, but were generally low caliber weapons to achieve the needed mobility orienting them toward offensive operations. RGA organizations utilized heavy, large caliber, long-range artillery designed for defensive operations. Doctrinally, the RFA was employed with the infantry units, as their artillery pieces would setup far behind advancing infantry and send rounds over friendly troops attacking enemy troops through indirect fire. RGA organizations were designed to protect a fort, a coastal city, or a sea port, and their artillery was permanent to its location due to its heavy weight. Finally, the RHA

⁵⁸ Dale Clarke, *British Artillery 1914–19: Field Army Artillery*, Vol. 94 (Oxford, UK: Osprey Publishing, 2004).

organizations were designed to provide flexibility of direct or indirect fire, mobility, and quick employment.

At the beginning of World War I, all artillery organizations consisted mainly of seasoned, career oriented troops; however, World War I depleted these well trained, seasoned soldiers. By early 1915, the British were suffering from a lack of RFA artillery trained personnel; thus, the RHA was re-missioned to support field artillery.⁵⁹ Before the end of 1915, the RHA was firmly part of the RFA, while on paper they were still a separate organization to support infantry. Additionally, the large heavy, long-range artillery pieces associated with the RGA were starting to become mobile through mechanization. These heavy pieces were far too large for horse or pack movement, but tractors and tracked vehicles could move them with ease. By the middle of World War I, RGA, RFA, and RHA were organized to work in unison far behind infantry units trying to advance forward.⁶⁰ By the end of World War I, all three artillery organizations were accustomed to working with each other with integrated fires based on maps and surveys. By 1918, the doctrine governing artillery operations had shifted to support this type of artillery interaction.⁶¹ However, not all lessons of conventional warfare easily transfer to irregular warfare, and the British did not have doctrine to address irregular warfare.

2. Aviation Doctrine

The Royal Air Force (RAF) was established in 1918, combining the Army and Navy aviation components into a single air force. There were several problems that developed from the combination of these assets into a new service. The Royal Army (RA) believed that the primary mission for aircraft should be close air support for ground forces, and the Royal Navy felt the mission should be strategic bombing. Additionally, the RAF did not publish any service doctrine until 1922; however, other internal documents suggest strategic bombing was the RAF's main focus following the end of

⁵⁹ Chris Baker, "The Royal Horse Artillery of 1914–1918: The Long, Long Trail," (accessed May 26, 2015), <http://www.1914-1918.net/rha.htm>.

⁶⁰ Hughes, *History of the Royal Regiment of Artillery: Between the Wars, 1919-1939*, 125.

⁶¹ Clarke, *British Artillery 1914–19: Field Army Artillery*, Vol. 94.

World War I.⁶² With no formal doctrine to guide the RAF, and operating in a time of limited resources, their success required finding a mission that limited cost and risk to personnel. This led the leadership of the RAF to consider all probable options in the Third Anglo-Afghan war.

Air Publication (AP) 1300 was the first RAF doctrine published in 1922. There was considerable overlap in this doctrine and the doctrine used by both the Royal Flying Corp (RFC) and the Royal Navy prior to the formation of the RAF. The first six chapters were adapted from the RFC, chapter eight was adapted from the Navy, and chapter eleven was adapted from a joint operations manual. Chapter seven was forged from the Third Anglo-Afghan War, and shaped the success of the RAF during the interwar period. This chapter highlights the need for air superiority, the need for reconnaissance in conjunction with bombing runs for after action assessment, and the need to respond offensively and defensively both in combat and non-combat operations. This doctrine enabled the RAF to deal with guerilla activity, as well as conduct political, conventional and unconventional military operations. More specifically, this chapter defined the RAF's idea of strategic bombing, both offensively and defensively.⁶³ This publication shaped the RAF around policing activities, and enabled much of their success throughout the interwar period.

D. TECHNOLOGY USED ON THE BATTLEFIELD

The Afghan Army deployed with a variety of rifles and artillery. According to General Molesworth, the Afghan army had modern German, Turkish and British rifles; however, the bulk of their force carried Martinis and Sniders, 19th century, obsolete relics of the British Empire. Though, the Afghan army did have a few four-barrel Gardiner machine guns. Artillery pieces consisted of modern Krupp howitzers and Krupp mountain guns; however, the bulk of the Afghan artillery pieces were obsolete as the preponderance of artillery used was black powder bursting charges.

⁶² Neville Parton, "The Development of Early RAF Doctrine," *Journal of Military History* 72, no. 4 (2008), 1158.

⁶³ *Ibid.*, 1155–1178.

The Afghan army was not mechanized so the logistical movement of these heavy artillery pieces was through horse or pack.⁶⁴ The Snyders and Martinis were the only rifles that had proliferated through the Afghan military and much of their ammunition was in poor condition due to age and poor storage practices. While the Afghan military appears as an ill-equipped conventional actor, the true strength of the Afghan military was in its tribal fighters.⁶⁵ The tribal fighters were generally better equipped and trained than the Afghan Army. Additionally, the tribal fighters outnumbered the Afghan military, and did not have the extensive logistical requirements as the army did. Additionally, the guerrillas lived and fought in the same area giving them an advantage in understanding of the environment and the ability to slip back into the population to avoid being decisively engaged with larger enemy forces.

While the British military in the Indian colonies was much smaller in numbers than prior to World War I, its weapons' technology integration was vastly superior to the Afghans. Artillery included Quick Fire (QF) 13-pounder, QF 18-pounder, and Breech Loading (BL) 60-pounder guns. Additionally, the British had an array of 3.7 inch, 4.5 inch, and 6 inch howitzers.⁶⁶ Much of the older low-tech gun artillery was drawn by horse, where some of the newer high-tech Howitzer artillery was pulled by tractor. With the exception of the cavalry units, the logistical lines were predominantly motorized for the British military; however, this proved to be problematic in the underdeveloped mountains of Afghanistan. The rolling chassis of the artillery and their tow-vehicles could not traverse much of the terrain, and ammo re-supply units had to trans-load resupplies from transport vehicle to horse drawn wagons to resupply units far removed from anything that resembled a road.

Finally, British aircraft the included the Bristol F2 fighter, the Royal Aircraft Factory B.E.2c, the Handley Page machine, the Airco D.H.9A, and the Airco D.H.10.⁶⁷

⁶⁴ George Noble Molesworth, *Afghanistan 1919: An Account of Operations in the Third Afghan War* (Bombay, NY: Asia Publishing House, 1962), 24–27.

⁶⁵ Fletcher, *Afghanistan: Highway of Conquest*, 189–190.

⁶⁶ Hughes, *History of the Royal Regiment of Artillery: Between the Wars, 1919–1939*, 125. Michael Barthorp, *Afghan Wars and the North-West Frontier 1839–1947* (London: Cassel, 2002).

⁶⁷ Towle, *Pilots and Rebels: The use of Aircraft in Unconventional Warfare 1918–1988*, 12–40.

The B.E.2c, the Handley Page machine, and the Bristol fighter were both pre-World War I aircraft. Additionally, both the D.H. aircraft entered service just prior to the end of World War I.

1. Artillery Technology

The artillery during this time period was categorized as light, medium, and heavy artillery. Light artillery tended to be more mobile with smaller caliber shells and shorter ranges. Additionally, British tactics employed used a variety of artillery types operating in unison, taking advantage of the increased range offered by heavy artillery to prevent replacement troops from reaching the front lines in a conventional war. As technology changed, the light artillery improved in accuracy, reduced weight making it more mobile, and increased the rate of fire. On the other hand, heavy artillery tended to get heavier, with larger heavier rounds, and a slower rate of fire. Mechanization enabled this change in heavy artillery, where before artillery units were limited to the weight a team of horses could pull.⁶⁸ For this time period, mechanization directly influences what may be high-tech. Some artillery may be considered low- or medium-tech when not mechanized, but high-tech when dependent on mechanization. Below is a comprehensive overview of each piece of artillery, for a complete capabilities review (see Table 1 in Appendix A).

The QF 13-pounder and 18-pounder guns were the oldest pieces of artillery used in this war, and were quickly followed by the BL 60-pounder gun. The QF 13-pounder and QF 18-pounder guns were nearly identical, and utilized some of the same ammunition components. The main difference was the carriage these guns were carried on. The QF 13-pounder gun was designed to be lighter to make it more maneuverable in the field; however, the lighter carriage made the gun less accurate, with a slower rate of fire compared to the QF 18-pounder gun. Both guns had a fixed type artillery round much like a modern bullet, where the round and propellant were cased in brass. This enabled a 20 round per minute rate of fire for the QF 18-pounder gun, and a slightly slower rate for the QF 13-pounder gun due to the weight issues previously discussed.⁶⁹ Additionally, the

⁶⁸ Clarke, *British Artillery 1914–19: Field Army Artillery*, 1–30.

⁶⁹ *Ibid.*, 24.

light weight of the QF 13-pounder gun prohibited the use of ammunition with a high propellant charge; it would damage the carriage from excessive recoil. Thus, the QF 13-pounder gun only had two types of ammunition, and the QF 18-pounder gun had eight types of ammunition. Both these guns are low-tech artillery pieces that benefit from interchangeable parts and operating crews.

The QF 4.5 inch and 3.7 inch howitzers were rated as medium-level artillery by the British, not to be confused with medium-tech. While these howitzers are labeled as quick fire artillery, they were much slower than the QF 13-pounder and QF 18-pounder guns listed above. The howitzers had separate type ammunition where the round and propellant were loaded separately with no brass casing. This slowed the rate of fire to six rounds per minute; however, the propellant could be adjusted based on range requirements increasing its overall flexibility in combat.⁷⁰ The 4.5 inch howitzer is clearly medium-tech for this conflict, as it is still horse drawn, relatively light and mobile with improved accuracy and range. The 3.7 inch howitzer appears to be more advanced as it was still experimental at the time of this conflict; however, it utilized low-tech rounds and mobility with an experimental high-tech field assembly process.⁷¹ Therefore, the 3.7 inch howitzer is also medium-tech.

While the BL 60 is an older piece of artillery, it was modified during World War I. These modifications made the artillery too heavy for horse drawn units; thus, it was adapted to tractor tow units, and limited its mobility.⁷² Additionally, these modifications did increase the effective range and accuracy, but it still suffered from a slow rate of fire. The required mechanization to support this artillery piece makes it high-tech, where the lighter horse drawn version would have been low-tech. The BL 6 inch howitzer was developed in 1915, and was relatively light for a heavy artillery piece; however, it was mounted on a pull trailer needed for World War I making it better suited for urban versus rural terrain. Additionally, the ammo for this unit was more advanced enabling a short or

⁷⁰ Nigel F. Evans, "British Artillery, World War II," (accessed May 21, 2015), <http://nigelf.tripod.com/gunsintro.htm>.

⁷¹ Clarke, *British Artillery 1914–19: Field Army Artillery*, 38.

⁷² *Ibid.*, 35.

long range option without adjusting the gun setup.⁷³ The BL 6 inch howitzer was towed by tractor during this conflict, suggesting it was an advanced model; thus, is considered high-tech.

2. Aircraft Technology

The aircraft during this time period were referred to as fighters, bombers, or reconnaissance aircraft; yet, they were not locked into these missions. It is helpful to examine the overall capability of each aircraft. Fighter aircraft tended to be smaller and faster, but generally had a shorter range of operation. Bomber aircraft tended to be the largest aircraft, needing the most support, but they generally had a high payload, longer range of operations at higher altitudes. Additionally, the tactics implemented by the British would have these bombers acting as reconnaissance aircraft as well to evaluate bombing effectiveness. Reconnaissance aircraft tended to be the middle ground with regard to size and needed support. They also tended to have more aircrew members that proved to enable more flexibility. Additionally, aircraft started to fly higher as the power output of their engines were improved. Below is a comprehensive overview of each aircraft. For a complete capabilities review (see Table 1 in Appendix B).

The first aircraft used in the Third Anglo-Afghan War was the Royal Aircraft Factory B.E.2c as part of an offensive operation to recapture lost territory.⁷⁴ Why was this aircraft chosen over more advanced aircraft that may have been available? RAF Squadron 99 was in British India with D.H.9a aircraft that were not utilized till later in the war.⁷⁵ Both of these aircraft were developed for the same mission, reconnaissance and bombing, but the D.H.9a could carry more bombs and fuel.⁷⁶ Additionally, the B.E.2c aircraft was obsolete by this time, and was retired following this conflict. Their involvement may have been related to the force that was in place at the time, a very

⁷³ Evans, "British Artillery, World War II," (accessed May 21, 2015), <http://nigelef.tripod.com/gunsintro.htm>.

⁷⁴ Towle, *Pilots and Rebels: The use of Aircraft in Unconventional Warfare 1918–1988*, 37.

⁷⁵ Philip JR Moyes, *Bomber Squadrons of the RAF and their Aircraft* (Detroit, MI: MacDonald, 1964), 127.

⁷⁶ Frederick Thomas Jane, and C. G. Grey, *Jane's all the World's Aircraft 1919, A Reprint of the 1919 Edition of all the World's Aircraft* (New York, NY: ARCO, 1969), 40a.

junior inexperienced force. On the other hand, this aircraft was one of the first to be put into service as it entered service in 1912; thus, this technology integration within the force was very high. Finally, this aircraft was used as the primary trainer aircraft for the RAF, and nearly all the pilots had been qualified on it as part of their training, and pilots available at the time may have limited the aircraft choice.⁷⁷

At the other end of the technological spectrum, the D.H.9a and D.H.10 aircraft used by the British were the most advanced in that series. The D.H.9a is an updated D.H.4, and the D.H.10 is an updated D.H.3. The D.H.9a engine has nearly double the horse power, fuel capacity, and payload capability of the D.H.4; however, it was slower at altitude and throughout the climb. The D.H.10 is an updated D.H.3, both were twin engine designs, and faster with higher payloads than the D.H.4 or D.H.9a. Again, the D.H.10 has more horse power, fuel capacity, and payload capability; yet, slower at altitude and in the climb.⁷⁸ Finally, the D.H.10 was not the only twin engine aircraft available, and was largely untested.

The Bristol Fighter and the Handley Page machine are good examples of medium-tech aircraft of the time. The Bristol F.2 Fighter entered service in 1916. This was two years prior to the D.H.9a's first flight, and four years after the B.E.2c. The Bristol Fighter was faster than all these aircraft, at altitude and in the climb; however, the fuel capacity was less than that of the D.H.9a, and more than the B.E.2c. The Bristol fighter offered better protection from ground fire, as it had metal plating around the engine and under the aircrew. Finally, the Bristol Fighter had a lower payload capacity compared to the D.H.9a, and higher capacity compared to the B.E.2c.⁷⁹ The Handley Page machine entered service in 1916, the same year as the D.H.3; however, it proved more capable in most ways, and the D.H.3 was retired in 1917. Based on that information, the Handley Page machine was the oldest twin engine bomber in service during the 1919, Third Anglo-Afghan War, and may be considered low-tech. How does the Handley Page machine compare to the D.H.10?

⁷⁷ Ibid., 35a.

⁷⁸ Ibid., 40a–53a.

⁷⁹ Ibid. 35a–114a.

The Handley Page machine V1500, used in the bombing of Kabul, held nearly 800 gallons more fuel, and had more powerful engines than the D.H.10. The Handley Page machine 0400 held nearly 100 gallons more fuel than the D.H.10 as well, giving both variants more flight time than the D.H.10; however, it was considerably slower than the D.H.10, and was much heavier.⁸⁰ Additionally, one could argue the D.H.10 would operate more efficiently at these lower weights, and this may negate the smaller fuel load capacity. All the aircraft operated at speeds between 70 and 130 MPH, all were propeller engines, and all could land or takeoff nearly anywhere. Examining the use of these technologies will highlight how the British managed a right-tech solution.

3. Military Operational Integration

The British Indian military took 62 pieces of artillery into the Khyber Pass, where the first combat operations took place; however, only 54 were operational during combat. The Peshawar area had 14 pieces in operation, and the Khaibar area had the remaining 40 pieces of artillery.⁸¹ It has been suggest the remaining artillery was left near a fort at the mouth of the pass.⁸² The British moved into the area of combat operation the day prior in a large heavy motorcade, a technique developed in World War I. This technique was abandoned the first day of combat due to terrain in the area.⁸³ On 6 May, 1919, the British units opened fire and were quick to push the Afghan military out of British India, and neutralize there artillery. However, tribal guerrilla reinforcements on the northern flank stopped the British advance, short of entering Afghanistan. The B.E.2c flew the first air mission in this war in support of British ground troops pinned down. This was a reactionary mission launched to support ground personnel after a perceived Afghan invasion into the British Indian colony. These aircraft performed light bombing within built up areas, and machine gun fire strafing runs for guerrilla fighters in the open.

⁸⁰ Ibid., 53a–150a.

⁸¹ Molesworth, *Afghanistan 1919: An Account of Operations in the Third Afghan War*, 25.

⁸² Hughes, *History of the Royal Regiment of Artillery: Between the Wars, 1919–1939*, 125–128.

⁸³ O’Ballance, *Afghan Wars 1839–1992: What Britain Gave Up and the Soviet Union Lost*, 59.

The guerrilla fighters had positioned themselves on the upper mountain ridgelines, and effectively neutralized the British artillery that was so effective on the open flat plain just days prior.⁸⁴ The maps the British artillery units had available for these indirect fire missions were inaccurate, not accounting for needed elevation changes. Additionally, the B.E.2c was so slow in the climb up to altitude; they would fly through the valley of the pass putting the guerrilla fighters above them. This was a position the B.E.2c could not defend against. As a result, the RAF utilized the Bristol Fighter, with a much faster rate of climb, to get above the ridge line and force the guerrilla fighters off the ridges.⁸⁵ The ground force commander felt these aircraft were so effective against the scattered enemy fighters that additional air support was requested and received throughout the remaining northern engagements.⁸⁶ Additionally, the Artillery units were able to assemble the 3.7 howitzers along the steep mountain areas where other artillery could not be utilized. This prevented the maneuvering guerrilla forces from advancing on their position as aircraft continued aerial bombardment. Finally, the RHA quickly abandon procedures developed for modern conventional warfare, and innovation enabled the QF 18-pounder guns to become very effective at direct fire terrain denial.

Initially, the RHA units had their artillery setup along with the RFA in a line behind the infantry; however, this left the cavalry exposed to guerrilla fighters maneuvering in the high ground. The RHA abandoned this after the infantry was pinned down on the first day, and started riding forward with the main cavalry units. When the cavalry approached guerrilla fighters, the RHA was able to setup the 18-pounder guns in less than a minute. Couple that with the 20 rounds per minute and four guns per cavalry unit, they quickly denied terrain to enemy fighters forced to move due to the air bombardment. Once enemy fighters were pinned down by the 18-pounder guns, the Bristol Fighters and B.E.2c aircraft could target them very effectively. As communication procedures with aircraft and the ground force became standardized, the artillery discovered these aircraft could request artillery, and quickly get them on target. Aircrew

⁸⁴ Molesworth, *Afghanistan 1919: An Account of Operations in the Third Afghan War*, 47.

⁸⁵ O'Ballance, *Afghan Wars 1839–1992: What Britain Gave Up and the Soviet Union Lost*, 60.

⁸⁶ Towle, *Pilots and Rebels: The use of Aircraft in Unconventional Warfare 1918–1988*, 37.

would call for fire, and observe the fall of the rounds. This was relayed via one way radio, and the assigned battery would adjust as requested and continue firing. When the artillery unit was accurately on target, the aircrew would say fire for effect and the battery would open fire with all its guns.⁸⁷ This innovation quickly enabled artillery units to accurately utilize indirect fire without accurate maps and survey data.

The British pushed the Afghan military back closer to the border, and the guerrilla fighters seemed to just disappear. As the British forces pushed further west, the short flight duration became problematic as the ground force was getting further from operating airfields. Additionally, ammunition was in short supply for the 3.7 howitzers. There was also a fear of a large guerrilla force counterattack along this northern pass into Afghanistan.⁸⁸ Thus, following the success of the British military around Dakka, Royal Army leaders chose to stay within the British Indian colony and not to pursue ground operations within Afghanistan. However, the RAF was able to go on the offensive.

Within Afghanistan, having complete air superiority, the RAF pursued bombing operations in Jalalabad and Kabul.⁸⁹ On 24 May, 1919, the Handley Page V1500 aircraft bombed Kabul, Afghanistan. This was a 3-hour one-way flight for this aircraft, which puts the mission duration around 6.5 hours. This extended mission duration eliminated all other aircraft, available to British India, from performing this mission.⁹⁰ Bomb payload may have also been a factor, as there were multiple targets within Kabul. This attack led to the evacuation of over half the city's inhabitants, and is believed to be a main factor that led the Afghan government to seek peace.⁹¹ Take note that the oldest bomber in the RAF was the only aircraft with this long strike capability, and keep in mind it was also a niche mission with this aircraft doing what it was designed for. This conventional offensive attack led to an expected reaction from the Afghan government, and is a clear example of a right-tech solution for the tactics being employed.

⁸⁷ Hughes, *History of the Royal Regiment of Artillery: Between the Wars, 1919–1939*, 209.

⁸⁸ Molesworth, *Afghanistan 1919: An Account of Operations in the Third Afghan War*, 39–52.

⁸⁹ Adamec, *Afghanistan, 1900–1923: A Diplomatic History*, 117.

⁹⁰ Chaz Bowyer, *Handley Page Bombers of the First World War* (Warwick: Aston, 1992), 142.

⁹¹ Towle, *Pilots and Rebels: The use of Aircraft in Unconventional Warfare 1918–1988*, 37.

While the British Indian Army found success in one location, the Afghan Army pushed forward in others. This led to continued operations within the British colony's western front against guerrilla fighters, and conventional Afghan military units. The Bristol fighter and D.H.9a were the primary aircraft operating during this time, and may have been due to reliability issues listed below. These aircraft were dropping bombs on embedded enemy fighters, and conducting strafing runs when they were out in the open. The success of the D.H.9a in this role led to it being re-missioned following the conclusion of this war. The D.H.9a was re-missioned for policing activity throughout the Middle East, used by the British and the Afghan government in this role.⁹² This became the primary mission for the RAF during the intra war period as well, and is seen in their doctrine. Unfortunately, as the war continued, and the British found themselves pushed back by Afghan forces from Khost.

Just as things stabilized around Dakka, Afghan military units, reinforced with tribal fighters, pushed into the Waziristan area to the south. British forces were forced to withdraw from this area before the end of May, and the British within the four surrounding areas were now being threatened. However, following the success found by the British in Dakka, plus the bombing runs over Jalalabad and Kabul, peace talks were underway. The British leaders did not want to risk more tribal fighters uprising at this stage of the war; thus, they used aircraft to drop leaflets informing tribesman of the talks to prevent any further unrest. Finally, there were rumors of Soviet aircraft arriving in Afghanistan to strengthen the Afghan garrison forces.⁹³ While the Afghan government was able to strengthen its position, the British were having problems with resupply lines.

Aircraft parts and artillery ammunition were beginning to affect combat operations for the British units. For aircraft operations, the main problem had to do with landing gear issues, from tires to struts. The aircraft with higher reliability rates, or low maintenance costs, were heavily utilized due to this resupply issue. At one point there was only one mission capable D.H.10, four D.H.9a's, and seven Bristol Fighters.⁹⁴ Thus,

⁹² Ibid., 37–41.

⁹³ Adamec, *Afghanistan, 1900–1923: A Diplomatic History*, 115–118.

⁹⁴ Towle, *Pilots and Rebels: The use of Aircraft in Unconventional Warfare 1918–1988*, 40.

the DH9a and Bristol Fighters saw the most use in theater from June to August. As for the ammunition issue, the 3.7 inch howitzer had the least available starting the campaign, and quickly lost its mobility advantage for this reason. Thus, the QF 18-pounder gun, with a large ammunition supply and innovative utilization, became the artillery of choice for the same time frame. Even with all the maintenance issues, it has been argued that airpower achieved savings in manpower and money through this conflict. Once the war officially ended, the Afghan government attempted to become more nationally oriented instead of a Muslim caliphate, following Turkey's lead.⁹⁵ This just continued to fuel the unrest in the tribesman, and continued to be problematic for the British throughout the interwar period.

E. TECHNOLOGY UTILIZATION EVALUATION

Overall, the British military was operating in a resource-deprived environment, in a harsh mountainous region, against conventional and irregular enemy forces. Furthermore, the British troops fighting this war had limited experience, and had no time for training for this specific situation; thus, innovation was necessary for the resources they had. The RA and RAF rely on tactical innovation to make the available weapons technology effective.

The mechanization for rapid movement and heavy artillery mobilization did not have great success within the Khyber Pass that was expected by the RA. Much of the mechanized transport was abandoned just prior to combat due to the mountainous terrain, and the RHA became heavily mobilized moving with the cavalry reverting back to direct fire operations.⁹⁶ This change in operation does not seem to surface in doctrine until the development of mortar teams introduced following World War II. On the other hand, the innovation of air directed fires to enable indirect fire missions in remote regions, lacking map and survey data, was incorporated in both the RA and RAF doctrine in 1922.⁹⁷ This

⁹⁵ David Loyn, *In Afghanistan: Two Hundred Years of British, Russian and American Occupation* (New York, NY: Macmillan, 2009), 128–132.

⁹⁶ Hughes, *History of the Royal Regiment of Artillery: Between the Wars, 1919–1939*.

⁹⁷ Neville Parton, "The Development of Early RAF Doctrine," *Journal of Military History* 72, no. 4 (2008), 1158.

was utilized heavily throughout the Inter War period, as the instability in these areas prevented survey teams from developing the maps needed to follow the World War I doctrine.

The RAF incorporated some form of bombing during most missions; yet, the only time the service went on the offensive it was strictly bombing runs deep in Afghanistan. When the missions were defending British troops, they used a combination of light to medium bombing with occasional machine gun strafing runs.⁹⁸ All of the operations during this war, and the continued policing activity following the war can be seen in their published doctrine of 1922. More important, the doctrine that was developed clearly highlights the RAF role in shaping, defensive and offensive operations. This did not exist during the Anglo-Afghan war, and only through innovation did the service find its place.

It becomes clear that the RAF favored the D.H.9a as it became their main aircraft in the Middle East for policing activities following this war, and the B.E.2c was retired.⁹⁹ Additionally, the QF 18-Pounder gun was favored by the RA throughout this period well into World War II.¹⁰⁰ The innovation used by aircrew with the D.H.9a, and other aircraft, was captured in their operating procedures, along with their artillery calls-for-fire procedures. The innovation by the RHA with the QF 18-Pounder gun was never incorporated into any operations manual but it remained a favored technology for some time, most likely due to its overall mission flexibility and reliability. Additionally, the use of aircraft for indirect fire missions in remote regions was incorporated with joint operating procedures being implemented.¹⁰¹ Finally, the RAF ultimately favored one of its most advanced aircraft, while the RA favored one of its oldest artillery pieces. What does this insinuate about the right-tech solution?

The preponderance of aircraft and artillery utilization was low- or medium-tech throughout this war, as might be expected in a resource-deprived environment. To evaluate the technology across time, I utilize a planning framework developed around the

⁹⁸ Towle, *Pilots and Rebels: The use of Aircraft in Unconventional Warfare 1918–1988*.

⁹⁹ Francis K. Mason, *The British Bomber since 1914* (London, UK: Putnam, 1994), 103.

¹⁰⁰ Clarke, *British Artillery 1914–19: Field Army Artillery*.

¹⁰¹ Hughes, *History of the Royal Regiment of Artillery: Between the Wars, 1919–1939*, 209–210.

shaping, defensive, and offensive operations previously outlined. Looking at the missions outlined in current U.S. irregular warfare doctrine, and general planning procedures focused on these operations, we are able to evaluate these technologies based on the operations outlined above.¹⁰² The analysis evaluates the artillery and aircraft utilization based on three outlined missions, using commander's guidance to adjust for battle field conditions. This analysis suggests that low-tech is generally more effective; however, in a resourced constrained environment, medium- or high-tech may be needed. More specific, when looking at the three mission categories independently, two out three times low-tech was the best solution because of innovation.¹⁰³

Both the RA and RAF weapon system operators were able to use innovative tactics and field technology adjustments to enable low- and medium-technology to be very effective. Additionally, the high-tech used was only effective when employed in specific missions. Most importantly, this highlights the fact that the British were able to get to a right-tech solution. Based on the weighted data, the QF 18-Pounder Gun and the QF 3.7 Howitzer represent a right-tech solution based on the environment and the proposed commander priorities for this conflict.¹⁰⁴ However, the British had the capability to improve its artillery through more innovation. The light weight design of the QF 13-Pounder was desired for maneuverability, but proved unstable and the QF 18-Pounder became the replacement. A lightweight carriage for the QF 18-Pounder may have required less horses while increasing accuracy.

The same can be said for the Aircraft used. Based on the weighted data, the Royal Aircraft B.E.2c and the Airco D.H.9a aircraft represent a right-tech solution based on the

¹⁰² See Appendix A and Appendix B for details on irregular warfare doctrine and the technology application details. The opening two to three pages of each appendix covers doctrine and missions for artillery and aircraft; additionally, the commanders priorities matrix is covered in detail.

¹⁰³ See Appendix A and Appendix B for complete technology analysis. Table 1 in Appendix A shows detailed technical information for the artillery the British Empire utilized in Third Afghan-Anglo War, and Table 2 contains the weighted artillery capabilities based on commander's priorities that may have existed during the Third Anglo-Afghan War. Table 7 in Appendix B shows detailed information on all the aircraft the British Empire utilized in the Third Anglo-Afghan War, and Table 8 contains the weighted aircraft capabilities based on commander's priorities that may have existed during the Third Anglo-Afghan War.

¹⁰⁴ See Table 2 in Appendix A.

environment and the proposed commander priorities for this conflict.¹⁰⁵ Adjusting technology available to these aircraft made them more effective based on battlefield innovation. Cameras were added when intelligence personnel identify the after action report conducted by aircrew as a limitation, as a result low-tech cameras were added to aircraft. Aircrew could see artillery impacts, and call in adjustments for ground personnel; thus, communications equipment was installed on the aircraft. However, little was done to address the high altitudes these aircraft were operating in. Portable oxygen bottles, like those on the bomber aircraft, may have enabled more operations in the high mountains of Afghanistan. Overall, the British were able to adjust their technology strategy and employment, which leads to a right-tech solution.

¹⁰⁵ See Table 8 in Appendix B.

THIS PAGE INTENTIONALLY LEFT BLANK

IV. IN-DEPTH CASE STUDY OF TECHNOLOGY STRATEGY IN THE SOVIET UNION'S AFGHAN WAR

Like the British Empire, Russia, and later the Soviet Empire, had been involved in Afghanistan throughout the 19th and 20th centuries. At the conclusion of World War II, the Soviet Union emerged as a superpower and by the 1950s, was involved in the Cold War with the United States. Afghanistan was a member of the non-aligned nations during the Cold War, and this status influenced the international community's involvement throughout the Soviet Afghanistan occupation of the 1980s. Examining the historical facts leading to the Soviet Afghanistan invasion of 1979 will emphasize their objectives and strategy. Military strategy and doctrine influences technology or weapons systems employment; thus, examining their doctrine before and throughout the war helps understand the Soviet planned technology integration to facilitate their success. Finally, examining the artillery and aircraft technology the Soviet Union used in shaping, offensive and defensive operations may highlight some successes and failures of their technology employment throughout the war.

The Soviet Union invaded Afghanistan in 1979 due to the instability caused by the Afghan civil war and the fear it would spread into the Soviet Union. The Soviets were able to quickly remove any conventional threat but soon found themselves involved in a long irregular war. The guerrilla fighters managed to wage an irregular war against the Soviets for nearly a decade. The Soviets quickly found themselves operating beyond their capability when facing the guerrilla fighters and the advanced weapons being supplied by external supporters. Throughout the war, the Soviets utilized an Afghan partner force for offensive operations against guerrilla fighters in an attempt to legitimize their supported Afghan government. Unfortunately, the Afghan forces did little to influence the people of Afghanistan, and the guerrilla threat continued to escalate. The Soviet military was successful when facing guerrilla fighters in the early stages of the conflict; however, they did not adapt their technologies to a changing environment as international involvement increased. Operating in a resource constrained environment, the Soviet military was initially able to develop a right-tech solution in a relatively short period of time through

effective technology integration. They did not adjust this solution when external actors changed the technology dynamics. Their failure to adjust enabled the guerrilla fighters to potentially have an asymmetric advantage at multiple levels, neutralizing the technology advantage of the Soviets. Finally, this failure to adjust to a right-tech solution continued to be problematic and ultimately led to the Soviet Union's withdrawal from Afghanistan in 1988.

A. THE SOVIET-AFGHAN RELATIONSHIP

In 1955, the Afghan government agreed to Soviet military and economic aid, and by 1957, this alliance was well underway. The Soviet military mission was to reorganize and modernize the Afghan Army and Air Force.¹⁰⁶ Over the next five years, the Afghan military would receive Soviet tanks, guns, military vehicles, aircraft, and updated communications equipment. Additionally, the Soviets had nearly 500 military advisors within Afghanistan, and the Afghan military grew to over 100,000 personnel under Soviet tutelage.¹⁰⁷ Finally, an agreement was signed that settled demarcation of the Soviet-Afghan border and renewed their treaty of Non-Aggression.¹⁰⁸ For the next decade, the political, military, and economic relationship between the two countries went quite well, with both countries benefiting. However, their relationship all started to change as political and social unrest grew within Afghanistan.

Between 1973 and 1979, political turmoil erupted within Afghanistan due to the ongoing civil war, and the existence of multiple external actors only increased the turmoil.¹⁰⁹ Of these external actors, the Soviet Union had the most direct influence within the Afghan government. As the political and social turmoil continued, many Afghans found themselves displaced from their homes and were now refugees. The fear of an unstable Afghanistan forced Soviet leaders into action, with the intent of stabilizing Afghanistan's government.

¹⁰⁶ O'Ballance, *Afghan Wars 1839–1992: What Britain Gave Up and the Soviet Union Lost*, 77.

¹⁰⁷ Henry St Amant Bradsher, *Afghanistan and the Soviet Union* (Durham, NC: Duke University Press, 1985), 28.

¹⁰⁸ O'Ballance, *Afghan Wars 1839–1992: What Britain Gave Up and the Soviet Union Lost*, 77.

¹⁰⁹ Bradsher, *Afghanistan and the Soviet Union*, 32–57.

In 1978, Soviet influence peaked as the Afghan President Muhammad Taraki changed the national flag, painted multiple government buildings red, and passed multiple reform acts that were communist in nature.¹¹⁰ With the political unrest, and refugees unable to flee to surrounding countries, the clan and tribal leaders of Afghanistan became enraged. By 1979, Islamist guerrillas were training within Pakistan and crossing the border using hit and run tactics in an effort to resist the new communist based Afghan government. In reaction, mass arrests and shootings occurred, culminating with the killing of the Muslim clergy. Additionally, the Afghan government launched large military operations to regain control after guerrilla attacks, resulting in many civilian casualties. Finally, in mid-December 1979, the Soviet Union decided to invade Afghanistan and install Karmal as the leader of Afghanistan.¹¹¹

B. GOING TO WAR

The Soviet Union took preemptive measures to facilitate their Afghanistan invasion of 1979. First, the Soviets attempted to remove any perceived threat from the Afghan military. Soviet Afghan advisors and maintenance personnel had most of the Afghan military equipment disabled to prevent any formidable military retaliation or resistance.¹¹² Second, the Soviet military mobilized and pre-staged a larger military force prior to the main Afghanistan invasion. Once the Soviet Union decided to invade they increased the number of Soviet military personnel in Afghanistan from roughly 1,500 to over 5,000 personnel, plus three airborne assault brigades. These forces secured airfields and vital lines of communication to facilitate the invasion force. Finally, measures were taken to influence the Afghan populace through political manipulation to include a Soviet supported government coup. Additionally, the Soviets used a new special unit, the Soviet Muslim brigade, in an effort to win the support of the populace. It was believed that this unit, through common religion and dialect, would show the Afghan people that

¹¹⁰ Loyn, *In Afghanistan: Two Hundred Years of British, Russian and American Occupation*, 138.

¹¹¹ O'Ballance, *Afghan Wars 1839–1992: What Britain Gave Up and the Soviet Union Lost*, 72–87. Loyn, *In Afghanistan: Two Hundred Years of British, Russian and American Occupation*, 135–142.

¹¹² Loyn, *In Afghanistan: Two Hundred Years of British, Russian and American Occupation*, 142.

cooperation with the Soviets was possible.¹¹³ These pre-invasion operations enabled a quick, effective invasion with minimal resistance.

On 27 December, 1979, the main Soviet invasion force moved into Afghanistan, including over 800 tanks and armored vehicles; within a week, nearly 50,000 Soviet military personnel arrived in Afghanistan. The Afghan president, Hafizullah Amin, was removed from office. On 28 December, the new Afghan president arrived at Bagram air base and was escorted to Kabul in a T-72 Soviet tank, escorted by the Soviet military, not the Afghan military. Within days, the Soviet military managed to secure all of its objectives, and Soviet leaders believed the only real threat to their future operations was potential Chinese involvement. Therefore, the order was given for Soviet troops to remain within the established military installations, giving priority to defensive operations.

The Soviet military mission was to provide security for all operational air bases, all government buildings, and critical lines of communication. This was the extent of their defensive operations. Aircraft, helicopter gunships, armored vehicles, and artillery were directly used by Soviet forces for the security of these strategic locations. The Soviet trained Afghan soldiers and the Special Muslim unit were the only forces conducting limited offensive operations, or combating guerrilla forces. By mid-1980, the offensive strategic concept basically failed. The Soviets expected their Special Muslim unit to win over guerrilla forces; however, just the opposite came to fruition. This unit was generally sympathetic to the guerrillas and gave guerrilla fighters Soviet weapons and intelligence.¹¹⁴ The Soviet leaders opted to withdraw all Soviet Muslim military members following the failures incurred with the Special Muslim unit. Afghan military mutinies became frequent, and mutineers often took the Soviet supplied weapons with them.¹¹⁵ As a result, Soviet forces deprived the Afghan military of its tanks, missiles, and weapons technologies in general. Finally, international pressure was mounting against the Soviet Union to withdraw from Afghanistan, and Pakistan was taking direct action to

¹¹³ O'Ballance, *Afghan Wars 1839–1992: What Britain Gave Up and the Soviet Union Lost*, 90.

¹¹⁴ *Ibid.*, 97.

¹¹⁵ *Ibid.*, 88.

support the guerrilla forces.¹¹⁶ Therefore, in July of 1980, the Soviet Union was forced to change its political narrative and military operations.¹¹⁷ From this point forward, the Soviet military was responsible for all shaping, offensive, and defensive operations.

C. DOCTRINE LIMITING RIGHT-TECH

Soviet military doctrine limited successful technology integration in multiple ways. The first limiting factor, influenced by World War II, focused on military structure and the concept of “the preparation of the rear.” This notion led to a very large military footprint, and much of it was non-deployable. The second limiting factor was the Soviet focus on infantry and armor as the primary offensive force, with all other military units operating strictly as supporting forces. Finally, Soviet military and political leaders based their doctrine on limited technology integration, limiting the effectiveness of technology, to decrease military expenses. These three factors contributed to the ineffectiveness of the military weapons technology throughout the Soviet-Afghan invasion and stifled internal innovation that may have led to a right-tech solution.¹¹⁸ Moreover, the Soviet military did not have a doctrine for low-intensity warfare, and was thus forced to use a theater warfare doctrine.¹¹⁹ These actions ultimately led the Soviet Air Force and artillery units to abandon their doctrine until it was changed in the late 1980s.¹²⁰

On September 17, 1939, the Soviets sent their military into Poland as part of a significant offensive operation; however, By June 1941, the Soviets were reeling from the German invasion. Internal military theorists believed that the Soviets failed to develop homeland defenses, with appropriate mobilization measures to enable quick defensive actions anywhere within the Soviet Union. According to William Odom on Soviet doctrine, “Unless the rear can be defended and its resources mobilized, there is little use

¹¹⁶ Bradsher, *Afghanistan and the Soviet Union*, 189–204.

¹¹⁷ O’Ballance, *Afghan Wars 1839–1992: What Britain Gave Up and the Soviet Union Lost*, 72–87. Loyn, *In Afghanistan: Two Hundred Years of British, Russian and American Occupation*, 140–145.

¹¹⁸ William E. Odom, “Soviet Military Doctrine,” *Foreign Affairs* 67, no. 2 (1988), 117.

¹¹⁹ William J. Olsen, “Air Power in Low-Intensity Conflict in the Middle East,” *Air University Review* 37 (1986), 11.

¹²⁰ Willard C. Frank and Philip S. Gillette, *Soviet Military Doctrine from Lenin to Gorbachev 1915–1991* (Westport, CT: Greenwood Publishing, 1992), 188–196.

in speaking of campaigns elsewhere.”¹²¹ In an effort to always have the force structure to defend against an invasion while being able to conduct offensive operations, the Soviet Union built the largest military force the world had seen since World War I. As a result, in 1979 the Soviet military had over five million personnel on active duty, and more the 55 million in the reserves; additionally, its weapons inventory consisted of more than 53,000 tanks, and 48,000 tubes of artillery.¹²² As a comparison, the United States active military force was just over two million, and a reserve size of less than one million.¹²³ Moreover, the Soviets produced four times the number of tanks as the United States. Finally, Soviet armor units were assessed to be quantitatively and qualitatively superior to the U.S. Army armor units.¹²⁴ These differences in numbers are far more extreme within the Soviet Army compared to their Air Force and Navy.

Soviet doctrine focused on three continuous land theaters: Europe, the Far East, and Southwest Asia. Additionally, “air power, rocketry and naval power have generally taken a back seat” when planning and preparing for offensive operations within these theaters, and instead focused on tanks and artillery to support infantry advances.¹²⁵ Therefore, air power was limited in the Afghan war simply based on numbers, and the need to defend the rear. To put it into raw numbers, the Soviet Air Force had approximately 6,894 fixed-wing aircraft, and 3,320 helicopters.¹²⁶ The Soviet Army had five times more tanks than their Air Force had aircraft, and ten times more artillery. As a final point, the Soviet Air Force lost 118 fighter aircraft and 333 helicopters during the war in Afghanistan, while the Army lost 147 tanks and 433 pieces of artillery.¹²⁷ That is significant considering that the Air Force lost ten percent of their helicopter fleet, and the

¹²¹ Odom, “*Soviet Military Doctrine*,” 117.

¹²² Ibid., 114.

¹²³ David Coleman, *U.S. Military Personnel 1954–2014*, (accessed Aug 4, 2015), <http://historyinpieces.com/research/us-military-personnel-1954-2014>.

¹²⁴ Paul F. Gorman, *U.S. Intelligence and Soviet Armor*, (accessed Aug 4, 2015), http://www.foia.cia.gov/sites/default/files/document_conversions/89801/DOC_0001066239.pdf, 1.

¹²⁵ Odom, “*Soviet Military Doctrine*,” 117.

¹²⁶ Edward B. Westermann, “The Limits of Soviet Airpower: The Failure of Military Coercion in Afghanistan, 1979–89,” *Journal of Conflict Studies* 19, no. 2 (1999), 1.

¹²⁷ Lester W. Grau, *The Bear Went Over the Mountain: Soviet Combat Tactics in Afghanistan* (Washington, DC: National Defense University Press, 1996), xix.

Army lost less than one percent of their armor to include artillery. How much more could the Soviets risk, and still protect the rear.

Due to the cost of operating a large military, the Soviets tried to be cost effective with their weapons technology integration and their employment tactics. Unfortunately, these employment tactics further exacerbated the problem with weapons technology integration. For example, the Soviet Army determined that each piece of artillery required ten percent more ammunition for each kilometer over ten kilometers.¹²⁸ To minimize this opportunity, in an effort to cut cost, artillery was deployed as close to the front as possible.¹²⁹ However, in the mountainous environment of Afghanistan the tanks were not able to engage targets on the ridge line due to gun limitations. This created a situation where the unprotected artillery, not up-armored artillery, was excessively exposed to enemy fire.¹³⁰ Soon this tactic was abandon when towed artillery or MRLS units were the only unit available for offensive operations. Additionally, offensive employment tactics changed for up-armored tracked artillery due to limited maneuverability in this environment.¹³¹ The totality of all these problems forced a military dependency on airpower.

The Soviets used airpower, for the first time, as their primary method for offensive and shaping operations. The tactics used for these new air operations caused a lot of helicopter maintenance issues, increased operational crash rates, and decreased weapons accuracy limiting their availability and operational effectiveness.¹³² The increased risk imposed on helicopter aircrew could have been reduced through the introduction of electronic countermeasures, and the accuracy issues could have been

¹²⁸ James F. Holcomb Jr., *Soviet Artillery Utilization* (Ft Leavenworth, KS: Army Combined Arms Center, 1988), 4.

¹²⁹ Ibid.

¹³⁰ Lester W. Grau, *Artillery and Counterinsurgency: The Soviet Experience in Afghanistan* (Ft Leavenworth, KS: Center For Army Lessons Learned, 1998): 4–8.

¹³¹ O’Ballance, *Afghan Wars 1839–1992: What Britain Gave Up and the Soviet Union Lost*, 104.

¹³² Westermann, “The Limits of Soviet Airpower: The Failure of Military Coercion in Afghanistan, 1979–89,” 5–8.

addressed with forward air controllers. However, neither of these was introduced in this conflict.

On the other hand, there are examples of innovation that increased operational capability, reduced risk to personnel and equipment, and by the war's end influenced doctrinal change. During the course of this conflict, artillery units developed new firing techniques, a new calculating device for this environment, and firing tables in an effort to target an elusive enemy within the mountainous terrain. Overall, these changes made the multiple-rocket-launch systems and the towed artillery pieces more accurate, enabled quicker targeting, and minimized the number of artillery pieces simultaneously firing. Additionally, the introduction of precision-guided munitions had limited success. Finally, the self-propelled mortar artillery pieces had the most success through tactical employment changes. The new calculating device enabled more effective standoff tactics and reduced the risk to force without sacrificing accuracy. However, towed and MRLS artillery pieces had minimal protective armor, and even with the new standoff tactics, this limited their use for offensive operations conducted in the mountains of Afghanistan.¹³³ While these innovations and changes increased effectiveness leading to doctrinal changes, the data analysis below demonstrates that with minimal modifications, or different equipment requests, the multiple-rocket-launch systems could have been far more effective.

D. TECHNOLOGY USED ON THE BATTLEFIELD

The Afghan Army and Air Force training and equipment mostly originated from the Soviet Union. The military structure was very similar to the Soviet structure to include their doctrine, training, and export weapons systems. As the political and social turmoil grew within Afghanistan, the loyalty of the military force waned, and desertion or mutiny became very common after 1973.¹³⁴ Additionally, the Soviet Union had military advisors and embedded maintenance personnel in the Afghan forces throughout the pre-invasion period. These factors were exploited by the Soviet planners for the main invasion.

¹³³ Grau, *Artillery and Counterinsurgency: The Soviet Experience in Afghanistan*, 2.

¹³⁴ O'Ballance, *Afghan Wars 1839–1992: What Britain Gave Up and the Soviet Union Lost*, 88.

The Soviet Union invaded Afghanistan on 27 December, 1979, and by the New Year the Afghan military was working with the Soviet military. Guerrilla forces were the only true opposition to the Soviet Union. As the conflict continued, international support for insurgents, or guerrilla forces opposing Soviet forces in Afghanistan, grew extensively.

Initially, guerrilla forces possessed only small arms such as the AK-47, but even these were in small supply as the Afghan civil war had depleted much of the tribal munitions. This changed as Pakistan, China, and Iran became directly threatened by the Soviet invasion. Pakistan, and to a lesser degree Iran, became safe havens for insurgents fighting the Soviet forces. The Pakistan Inter-Service Intelligence (ISI) was training insurgents and sending them to Afghanistan with weapons supplied by China.¹³⁵ In July of 1980, the Soviets transitioned from invasion to stability operations, and the guerrilla forces started to receive weapons and aid from more external actors to include the United States. By 1982, the Mujahideen was receiving \$600 million a year from the United States in weapons and training supplies.¹³⁶ This significantly improved the mujahedeen's ability to continue a successful insurgency against the Soviet forces in Afghanistan.

Low-tech weapons requiring minimal training were generally best suited for these guerrilla fighters; additionally, the external actors did not want the Soviets to know they were supporting the guerrillas and limited the type of weapons to those of Soviet origin.¹³⁷ Thus, the main weapons supplied to guerrilla forces were mortars, rocket-propelled grenade launchers (RPG), Degtyaryov-Shpagin (DShKM) 12.7mm heavy machine guns, and ZPU 14.5mm heavy machine guns. As the Soviet-Afghan war continued, Soviet weapon availability became limited, and the origins of a weapons system no longer became a determining factor. Pakistan ISI established training centers for guerrilla fighters, and this enabled the introduction of more complex weapons systems. By the mid-1980s, guerrilla fighters had 107mm Chinese multiple rocket launchers (MBRL), Russian Strela-2 surface-to-air-missiles (SAM), and the United States

¹³⁵ Mohammad Yusuf, and Mark Adkins, *Afghanistan The Bear Trap: The Defeat of a Superpower* (Havertown, PA: Casemate, 2002), 20.

¹³⁶ Gilles Kepel, *Jihad: The Trail of Political Islam* (Cambridge, MA: Harvard University Press, 2002), 143.

¹³⁷ Loyn, *In Afghanistan: Two Hundred Years of British, Russian and American Occupation*, 149.

Stinger SAMs.¹³⁸ While there was a technology shift for the guerrilla fighters, it came at a cost. Guerrilla fighters were required to go through training in Pakistan, which removed them from the fight, and the external actors controlled the inflow of weapons. Additionally, it created a requirement for logistics to move the weapons into place for use in both training and combat.

The Soviet military weapons technology integration had dramatically increased between World War II and the 1979 Afghanistan invasion, possibly due to the ongoing Cold War. However, the Soviets did not utilize all military forces or technology that was available to them. The Soviets primarily utilized eleven different artillery pieces during this war.¹³⁹ Additionally, they tended to maneuver with mostly medium-tech supported by low- or high-tech artillery units. Maneuvering units utilized self-propelled howitzers or mortar artillery, with support from defensive artillery units.¹⁴⁰ The defensive units utilized medium-tech artillery to support maneuvering units, and utilized their high-tech for counterbattery missions.

As for the Soviet Air Force, they mostly used ten aircraft types during this conflict.¹⁴¹ The Soviets utilized low- to high-tech aircraft throughout most operations, with no clear separation by mission type. The Cub and Hound were the oldest aircraft utilized by the Soviets, and were both low- to medium-tech. The Frogfoot was the newest aircraft in the Soviet inventory, and was definitely high-tech. This does not include all aircraft utilized by the Soviets. There are reports of medium to long range bombers operating out of the Soviet Union during major offensive operation.¹⁴² While these

¹³⁸ Grau, *The Bear Went Over the Mountain: Soviet Combat Tactics in Afghanistan*. Yusuf, *Afghanistan The Bear Trap: The Defeat of a Superpower*, 4–95.

¹³⁹ The eleven types of Artillery used by the Soviets included: the RPU-14, the Boyevay Mashina (BM) BM-21 Grad, the BM-27 Uragan, the 2S1 Gvozdika, the 2S3 Akatsiya SO-152, the 2S4 Tyulpan, the 2S9 Nona-s 120mm howitzer, the 2B9 Vasilek 82mm gun-mortar, the M-46 130mm gun, the D-20 152mm howitzer, and the D-30 122mm Howitzer. See Table 3 in appendix A for technical data.

¹⁴⁰ Grau, *Artillery and Counterinsurgency: The Soviet Experience in Afghanistan*, 4.

¹⁴¹ The ten most common aircraft employed by the Soviets include: the Sukhoi (SU) SU-25 Frogfoot, the SU-24 Fencer, the SU-17 Fitter, the Mikoyan-Gurevich (MiG) MiG-23 Flogger, military (Mi) Mi-24 Hind, Mi-8 Hip, Mi-4 Hound, Ilyushin (Il) Il-76 Candid, the Antonov (An) An-22 Cock, and the An-12 Cub. See Table 9 in appendix B for technical data.

¹⁴² Denny R. Nelson, "Soviet Air Power: Tactics and Weapons Used in Afghanistan," *Air University Review* 36, no. 2 (1985).

aircraft fit into shaping operations, their limited use over the ten year conflict prevents any real data analysis. Additionally, their operating environment was significantly different, as takeoff and landing was in the Soviet Union with much better airfield operations.

1. Artillery Technology

During the Soviet-Afghan war, the Soviets divided their artillery into three distinct groups: the Regimental Artillery Group (RAG), the Division Artillery Group (DAG), and the Army Artillery Group (AAG). Understanding this structure helps identify the limitations of the technology employed by the Soviets during this conflict. RAGs generally consisted of two to four battalions, each battalion consisting of 240 to 260 personnel with 18 artillery pieces. RAGs targeted enemy personnel or equipment that hindered the advance of attacking Soviet forces, referred to as a maneuvering unit. These may have been shaping fires, done well in advance or during the offensive. RAGs were generally concerned with short range requirements. DAGs, referred to as defensive units, consisted of two to four battalions with the same general structure as RAGs; however, DAGs may have been required to support an AAG during defensive operations, or a RAG during offensive operations. DAGs generally had medium to long range artillery, and could assume the role of an AAG for mobile units. AAGs were made up of remaining allocated artillery battalions not pushed down to a DAG or RAG. The AAG mission was generally defensive counterbattery or attacking deep targets; thus, they were made up of longer range artillery pieces. Each of these units always employed a Fire Direction Center (FDC) to coordinate fires from all supporting artillery pieces, even when operating independently of the main force.¹⁴³ Below is a comprehensive overview of each piece of artillery, for a complete review of artillery capabilities see Table 3 in Appendix A.

The M-46, 2B9, D-20, D-30 and RPU-14 are towed pieces of artillery utilized by the Soviet military during this war. With the exception of the RPU-14, these artillery

¹⁴³ United States Army, *The Soviet Army Operations and Tactics* (FM 100-2-1) (Washington, DC: Department of the Army, July 16, 1984), 1–23, 9–1.

pieces are gun based artillery weapons. The D-20 and D-30 are howitzers, which have the capability of shooting up high ridgelines thanks to their extended elevation ranges. The M-46 is more of a traditional artillery gun with a limited elevation range, making it more suited for direct-fire missions. The 2B9 is an advanced automatic 82mm gun-mortar piece with a four round clip and the largest elevation range within these towed artillery pieces.¹⁴⁴ Finally, the RPU-14 is a towed variant of the BM-14 comprised of a 140mm Multiple Launch Rocket System (MLRS). The RPU-14 is limited by rocket range and not its elevation. The RPU-14 was replaced during this war by the BM-21.¹⁴⁵ While the RPU-14 may be considered medium-tech due to its rocket technology, the rest of these artillery pieces represent low-tech artillery utilized by the Soviet military during the Soviet Afghan war, and all benefit from low maintenance and simplicity.

The 2S1, 2S3, 2S4, and 2S9 are all track-style, self-propelled artillery pieces. The 2S1 through 2S4 entered service well before the Soviet invasion of Afghanistan. The 2S9 did not enter service until 1981, and did not enter this conflict until 1984.¹⁴⁶ The 2S9 is the lightest, fastest, most maneuverable artillery piece of the tracked units, with the highest rate of fire.¹⁴⁷ The 2S1 is a close second with a near equal rate of fire, its larger caliber rounds, and its longer range compared to the 2S9. These two artillery pieces have the same travel distance and max speeds, but the 2S1 is double the weight and sacrifices maneuverability. The 2S3 and 2S4 are much heavier artillery pieces with much slower rates of fire; they would likely be used for counterbattery missions or deep target destruction. Additionally, the 2S4 had PGM rounds.¹⁴⁸ All of the S-series artillery pieces utilized by the Soviets in this conflict are medium-tech unless using PGMs. The 2S4 utilizing PGMs would have been high-tech during this war.

¹⁴⁴ Hull, Markov and Zaloga, *Soviet/Russian Armor and Artillery Design Practices: 1945 to Present*, 1–17, chapter 6. Christopher F. Foss, *Jane's Armour and Artillery 1984–85* (New York, NY: Jane's, 1985), 580–594.

¹⁴⁵ Foss, *Jane's Armour and Artillery 1984–85*, 685.

¹⁴⁶ Andrius Genys, *2S9 Nona-s 120-mm self-propelled mortar system*, Military-today (accessed July 1, 2015), http://www.military-today.com/artillery/2s9_nona_s.htm.

¹⁴⁷ Hull, Markov and Zaloga, *Soviet/Russian Armor and Artillery Design Practices: 1945 to Present*, V-32.

¹⁴⁸ Foss, *Jane's Armour and Artillery 1984–85*, 464–468.

The BM-21 and BM-27 are self-propelled wheel-based MRLS artillery pieces utilized in this war. The BM-21 is a 40-round 122mm MLRS that entered service in the mid-1960s, offered short and long range rockets, and is still in service today. The truck based unit carried two full ammo loads for a total of 80 rockets, had a max speed of 46 MPH, and a max range of 251 miles. The BM-27 is a 16-round 220mm MLRS that entered service in the mid-1970s, and is still in service. The BM-27 also offered short and long range rockets, had a max speed of 40 MPH, and a max range of 310 miles.¹⁴⁹ The BM-21 was medium-tech, and the BM-27 was high-tech during this war.

2. Aircraft Technology

The Soviet military aircraft employed in this war fall into three categories: airlift, fighter, and rotary-wing. These aircraft were not locked into a specific mission role as these categories may suggest, and examining these aircraft through shaping, offensive and defensive operations helps identify their mission effectiveness. Fighter aircraft tended to be faster, and smaller than other fixed-wing aircraft. Additionally, they tended to have more advanced weapons systems for multirole capability. Airlift aircraft tended to be larger aircraft with longer flight duration. Airlift aircraft also had higher payloads, and required less maintenance support; however, they were less maneuverable with the least mission flexibility, generally restricting them to lift operations. Finally, rotary-wing aircraft were used as transport, reconnaissance, and strike aircraft making them appear to be the most mission flexible; however, they tended to be payload limited, with shorter flight durations and limited altitude capabilities. Below is a comprehensive overview of each aircraft utilized by the Soviet military in this war. For a complete capability review of each aircraft, see Table 3 in Appendix B.

The first aircraft used in the Soviet invasion of Afghanistan were airlift assets shaping the military force up to three weeks prior to the planed invasion. The Il-76 Candid was utilized extensively throughout this conflict, and was the only jet engine equipped airlift aircraft used. The Candid moved over seventy percent of all cargo and personnel moved by air; additionally, it could carry heavy loads while still operating on

¹⁴⁹ Ibid., 682-686.

short unpaved poorly maintained runways. While the Candid moved the most cargo throughout the war, the An-22 Cock was favored during the initial invasion. When the An-22 entered service it was the largest turboprop aircraft; furthermore, with its unique twelve wheel main landing gear setup, this aircraft could land on soft unprepared surfaces. Finally, the An-12 Cub was the smallest of the aircraft utilized for intra-theater airlift. This aircraft proved to be a multirole aircraft, as it performed airlift, reconnaissance, and bombing runs during this war.¹⁵⁰ The An-12 was the oldest airlift aircraft utilized during this war, and formed the “backbone” of the Soviet mobility command.¹⁵¹ The An-12 Cub is low-tech, while the An-22 and Il-76 are both medium-tech. The An-22 Cocks complex landing gear brings this aircraft up to medium-tech, and the dirt strip cable engines of the Il-76 reduce it to medium-technology.

The rotary-wing aircraft were use more than any other type of aircraft in offensive and defensive operations. The Mi-4 (Hound) was the oldest rotary-wing aircraft used in this war. The Hound is a single engine transport helicopter, and the Mi-8 (Hip) was designed to replace it. The Hound went out of production in 1979, but remained in service throughout this war. The Hip is a twin-engine design with increased lift and mission capability compared to the Hound. The Hip could carry double the payload, and eight more passengers; however, it had a lower altitude capability, and shorter flight duration. The Hip also had rockets and anti-tank missiles for use in conjunction with personnel insertion during offensive operations, or for rapid base defense operations. The Mi-24 (Hind) is a gunship attack helicopter. While its mission design is focused on attack, the Hind does have transport capability. The Hind can carry half the personnel of the Hound, but more weight. The Hind is in the middle with respect to altitude capability, but was the fastest most complex rotary-wing used in this conflict. The weapons system was so complex it required a weapons officer in addition to the two pilots, but it was very

¹⁵⁰ Nelson, “Soviet Air Power: Tactics and Weapons Used in Afghanistan,” 30.

¹⁵¹ Andrius Genys, *Ilyushin Il-76 Candid Long-range transport aircraft*, Military-today, (accessed July 7, 2015), http://www.military-today.com/aircraft/ilyushin_il76_candid.htm. Antonov An-22 Antei Heavy transport aircraft, Military-today, (accessed July 7, 2015), http://www.military-today.com/aircraft/an_22.htm. Antonov An-12 Tactical transport aircraft, Military-today, (accessed July 7, 2015), http://www.military-today.com/aircraft/an_12.htm.

effective.¹⁵² Finally, the Hind is an all-weather helicopter, and is the least vulnerable to small arms fire. These two capabilities prove to be very problematic for the other Soviet helicopters.¹⁵³ The Mi-4 Hound was low-tech at the time of this conflict. The Hip was medium-tech with its twine engine and weapons capabilities. Finally, the Hind was high-tech due to its advanced engine and weapons system design.

The MiG-23 Flogger and Su-17 Fitter were the oldest fighters used in this conflict. The primary mission of the Flogger was air-to-air operations with limited air-to-ground operations.¹⁵⁴ The Fitter was primarily used for air-to-ground operations, supporting ground troops or performing bombing runs. The Su-25 Frogfoot was the newest, only close-air-support (CAS) designed fighter utilized by the Soviets during this war. The Frogfoot proved more agile and accurate compared to the Fitter; however, the Fitter proved to be more reliable in the harsh Afghanistan environment.¹⁵⁵ There were more Su-25 Frogfoot aircraft within Afghanistan than any other aircraft, and was primarily used for ground attack; however, with full weapons load, its altitude was limited to 16,500 feet.¹⁵⁶ The Su-24 Fencer was designed as a high speed low-level strike aircraft, and was utilized in the mid-1980s as a replacement for the Fitter. The Fencer had electronic countermeasures for ground-to-air threats, and a shorter takeoff capability than the Fitter; however, much like the Frogfoot, the Fencer was not as reliable as the Fitter. All of these aircraft are high-tech for this conflict; however, the Frogfoot is the most advanced with respect to CAS support, and the Flogger is the most advanced with respect to air-to-air engagements.

¹⁵² Fredrick Thomas Janes, *Jane's all the World's Aircraft 1984–85*.

¹⁵³ Richard Anthony Mason and John William Ransom Taylor, *Aircraft, Strategy, and Operations of the Soviet Air Force* (London: Jane's, 1986), 87.

¹⁵⁴ *Mikoyan MiG-23 Flogger tactical fighter*, Military-today, (accessed July 9, 2015), http://www.military-today.com/aircraft/mikoyan_mig_23_flogger.htm.

¹⁵⁵ Captain Jack, *Sukhoi Su-17 / Su-20 / Su-22 (Fitter) - Ground Attack / Strike Fighter - History, Specs and Pictures*, Military Aircraft. Military Factory, (accessed July 9, 2015), http://www.militaryfactory.com/aircraft/detail.asp?aircraft_id=192.

¹⁵⁶ Yefim Gordon and Alan Dawes, *Sukhoi Su-25 Frogfoot: Close Air Support Aircraft* (London: Airlift, 2004), 133–135.

3. Military Operational Integration

This conflict had five distinct phases. The first phase is pre-invasion through mid-1980. The second phase, mid-1980 through late 1982, the Soviets were fighting an offensive and defensive conflict with the weapons technology planned only for defensive operations. While there was a quick shift to achieve needed manpower during this phase, the approval and logistics for the weapons took much longer. It was late 1982 before the weapons strength would grow to adjust for the new operational strategy.¹⁵⁷ The third phase, late 1982 through early 1984, the Soviet weapons technology shifts and becomes very effective on the battle field. During this phase the Mujahideen were working with external actors in an effort to counter the new Soviet capabilities.¹⁵⁸ The fourth phase, early 1984 through late 1985, the Mujahideen fielded new counter air weapons technology to include heavy machineguns and the SA-7. The heavy machine guns could employ easily against air or ground forces. The fifth phase, late 1985 through the Soviet withdrawal in 1988, the Mujahideen fielded their final counter air weapon, the Stinger.¹⁵⁹ Most of the daily fighting took place in eastern Afghanistan, in the mountains near the Pakistani border, and within or near major cities throughout the war. Thus, these areas, along with military base and lines-of-communication (LOC) defense, are the focus areas for examining technology effectiveness.¹⁶⁰

Following the Soviet invasion of Afghanistan, their military forces quickly set a defensive posture. Soviet troops remained within established bases, and aircraft and artillery were used to secure these locations along with vital LOCs. Large artillery pieces protected key locations along the LOCs, and aircraft supported convoys moving along them. As pointed out earlier, the Soviets changed to an offensive and defensive role due to the ineffectiveness of previous measures, and Soviet forces swelled to over 100,000. While there was a large increase in military force, less than 1,000 personnel participated

¹⁵⁷ O'Ballance, *Afghan Wars 1839–1992: What Britain Gave Up and the Soviet Union Lost*, 122.

¹⁵⁸ Loyn, *In Afghanistan: Two Hundred Years of British, Russian and American Occupation*, 148–149.

¹⁵⁹ Leonard Leshuk, “Stinger Missiles in Afghanistan,” *Europa University Press* (2008), (accessed July 14, 2015), http://europauniversitypress.co.uk/auth_article416.html.

¹⁶⁰ O'Ballance, *Afghan Wars 1839–1992: What Britain Gave Up and the Soviet Union Lost*, 128.

in offensive operations on a daily bases and large offensive operations did not exceed 7,000.¹⁶¹ Furthermore, barely 10 percent of active military personnel served in Afghanistan, and Soviet military members would rotate back to the Soviet Union every six months.¹⁶² These are important points, as it hampers innovation on the battle field when personnel are not committed to the conflict holistically. Finally, with such a limited force conducting offensive operations, the tactics changed very little to enable more effective offensive operations; rather, they only changed tactics to limit risk, and sacrificed accuracy in the process.¹⁶³

The small offensive forces were a deliberate tactical change that developed during the second stage of the conflict. This developed from the failures of large conventional type units moving into the mountains north of Kabul in an attempt to push out guerrilla fighters. Prior to this tactical change, the typical offensive operation consisted of 5,000 personnel. The Soviets would shoot howitzer based artillery, such as the 2S1 and 2S9, into the mountains for three to four days; additionally, air assets would bomb any location needed that was out of range for the artillery. The caves in the area provided security to guerrilla fighters, and the shaping fires served as a warning of an enemy attack. Helicopters would insert small tactical units along ridgelines and on building tops for over watch during these large offensive operations, however, these operations failed to block the withdrawal of guerrilla forces.

During the typical offensive advance, spotters on the ridge lines would call for artillery as targets appeared. The artillery units were using normative firing tables as spotters called for artillery. These firing tables were designed for large targets where only general accuracy was needed. This meant artillery units had to use heavy bombardment for small targets. The Mujahideen would use 20 to 200 personnel to attack during the night, a smaller force than Soviet artillery tactics were designed for, allowing them to slip away. Additionally, the guerrilla fighters developed a tactic of splitting off a rear portion

¹⁶¹ Yossef Bodansky, "The Bear on the Chessboard: Soviet Military Gains in Afghanistan," *World Affairs* (1982), 278.

¹⁶² Grau, *The Bear Went Over the Mountain: Soviet Combat Tactics in Afghanistan*, xix.

¹⁶³ Ibid.

of its fleeing units to throw off Soviet surveillance units. This enabled a successful withdrawal under heavy artillery bombardment.¹⁶⁴

In one of the largest offensive operations during this stage, the battle for Panjshir Valley, the Soviets sent in 15,000 troops, 150 Mi-24 gunships, and towed artillery. The fighting lasted about six weeks. The Soviets suffered 3,000 casualties, lost 50 vehicles, and 35 helicopters. Additionally, large numbers of Afghan regulars defected.¹⁶⁵ Soviet tactics were not designed for mountainous environments, like that of Afghanistan, which limited their effectiveness. The guerrilla forces, with small arms, mortars and RPGs, inflicted enough casualties to stop the Soviet offensive prior to clearing the region.

Besides these large offensive operations, the Soviets continued to expand their defensive measures around major cities and LOCs. They built a three layer defensive posture around Kabul that stretch 20 miles outside the city. It included bunkers, gun emplacements, and mines. The mission for over 60 percent of Soviet forces was to secure Kabul and the roads linking it to Kandahar and Herat.¹⁶⁶ Yet, insurgents were continually able to carry out successful shootings, bombings, and assassinations. As the defensive measures proved ineffective, the Soviets turned to its Air Force to reduce guerrilla resources through large bombing campaigns. The Soviets targeted key guerrilla support infrastructure including irrigation systems, orchards, cropland, farms, villages and livestock. The Soviet Air Force believed by targeting these resources, the local population would stop supporting the guerrilla forces and the overall insurgent resistance would collapse.¹⁶⁷ However, this also created large refugee camps in Pakistan and Iran that served as resistance recruiting grounds outside the Soviet influence; additionally, the bombing campaigns upset the international community due to their harsh nature, and civilian casualties.

¹⁶⁴ Grau, *Artillery and Counterinsurgency: The Soviet Experience in Afghanistan*, 4.

¹⁶⁵ Robert F. Baumann, *Russian-Soviet Unconventional Wars in the Caucasus, Central Asia and Afghanistan* (Ft Leavenworth, KS: Combat Studies Institute, 1993), 138–143.

¹⁶⁶ *Ibid.*, 136.

¹⁶⁷ Lester W. Grau, “The Soviet–Afghan War: A Superpower Mired in the Mountains,” *Journal of Slavic Military Studies* 17, no. 1 (2004), 134–135.

By late 1982, the start of the third stage, the approval from the Soviet government finally allocates more resources; additionally, new logistical routes and capabilities became available. This sped up the Soviet logistical operations in support of the Afghan campaign. Armored self-propelled artillery, along with unarmored MRLS units, started pouring into Afghanistan. These self-propelled artillery pieces proved to be far more effective in the mountainous regions than tanks. The main guns on Soviet tanks were generally limited in elevation, and could not be effectively employed against guerrilla units. However, the unarmored MRLS units needed protection from the armored units as they maneuvered to engage guerrilla fighters. With tanks unable to protect the MRLS units, they eventually become defensive weapons for outposts. This is also true of towed artillery, such as the D-30. These vehicle mounted MRLS units could respond quickly to an attack with their direct fire effectiveness; yet, be protected by other outpost defensive measures.¹⁶⁸ Ultimately, this was a wasteful use of this artillery. These units only needed minor modification, for protection, to enable their use in offensive operations.

The Soviets found they needed the effectiveness of an MRLS unit, and its accuracy, in their offensive units; yet, they needed better protection against direct attack. This stage sees the introduction of the 2S4 armored self-propelled artillery battery. These units had the capability of effective indirect fire from the rear of an offensive if needed, as they were a gun based piece of artillery. Moreover, they had laser-guided rounds that proved very effective at destroying enemy strong points with direct fire. Finally, they were more protected against enemy direct attack when compared to the vehicle mounted MRLS artillery pieces.¹⁶⁹ The 2S4 did have its own limitations, its range was slightly limited compared to the MRLS pieces, and its rate of fire was extremely limited. Comparing the BM-21 Grad to the 2S4, the BM-21 out ranged the 2S4 by 2,000 meters, and could fire all 40 rockets in less than a minute; yet, it had not self-protection or indirect fire capability.

Air assets also increased during this time, bringing Soviet airpower up to 281 fighters, 220 helicopters including 48 gunships, and 76 transport and reconnaissance

¹⁶⁸ Grau, *Artillery and Counterinsurgency: The Soviet Experience in Afghanistan* (1998), 4–8.

¹⁶⁹ Ibid.

aircraft.¹⁷⁰ While the increase in assets was an effort to improve overall military strength, it was also due to reliability issues that developed from shifting combat tactics. The Hind was vulnerable to small arms fire from the side, when being engaged by enemy personnel on ridge lines at a co-altitude. Small arms fire from above and below were not as problematic. Hind helicopter gunship crewmember found that flying lower and faster made them less vulnerable to small arms fire in the mountainous regions. However, they did not train for this type of flying, and it led to more accidents. The rotors on the Hind were not meant for prolonged low-level flight either and it led to maintenance issues. Finally, this new tactic also meant changing target engagement tactics, and their new target engagement tactics reduced accuracy. The reduction in accuracy and reliability was adjusted for with increased numbers, and the Hind became very effective at combating guerrilla fighters and at providing over watch for ground troops.¹⁷¹

The fighter aircraft shifted to a fighter and bomber type mission set that included ground support. However, the speed and threat of small arms fire made it difficult for the aircraft to provide effective air cover for ground troops in the mountains. Therefore, they shifted missions to heavy indiscriminate bombing on villages in the flat land regions, and along guerrilla supply lines in the mountains.¹⁷² Additionally, large bombing campaigns were conducted against larger cities, like Herat, that might show support to the insurgents. While these were brutal tactics, the aircraft performing these bombing campaigns performed very well.¹⁷³ Finally, the Frogfoot and the Fitter had proved the most effective fixed-wing aircraft at performing CAS. This led to an additional Frogfoot unit deploying to Afghanistan, doubling the number of Su-25 aircraft in country. The Frogfoot was much slower than the other fighter aircraft, and was able to be more effective supporting ground personnel in all environments. The Fitter had far less maintenance issues caused by the harsh environmental conditions, and was heavily utilized for ground support when the Frogfoot was unavailable.

¹⁷⁰ O'Ballance, *Afghan Wars 1839–1992: What Britain Gave Up and the Soviet Union Lost*, 122.

¹⁷¹ Nelson, *Soviet Air Power: Tactics and Weapons Used in Afghanistan*, 30–44.

¹⁷² Olsen, *Air Power in Low-Intensity Conflict in the Middle East*, 7.

¹⁷³ Westermann, *The Limits of Soviet Airpower: The Failure of Military Coercion in Afghanistan, 1979–89*, 5–7.

By late 1984, the fourth stage of the war, the Mujahideen starts fielding weapons provided by external actors to counter the Soviet air campaign. Multiple variants of Soviet heavy machine guns, RPGs, and the SA-7 make their way into the mountains of Afghanistan as the Mujahideen start to counter the Soviet air threat. By early 1985 the Soviets are losing 150–200 aircraft to enemy fire per year. Finally, by late 1985, the fifth stage of the war, the U.S. provided the stinger missile to the Mujahideen. While the supply of stinger missiles remains limited, the volume gradually increased throughout 1986–87.¹⁷⁴ Additionally, the Soviet aircraft in Afghanistan did not have countermeasures that were effective against the stinger. As a result, Soviet air tactics shift again, along with a political narrative shift. Aircraft were more vulnerable to the Stinger missile at low level with high engine output due to the increased inferred signature. No helicopter was safe flying close to the ground, and they shift to high flying; additionally, they start employing their weapons at near max range making them less effective.¹⁷⁵

The political narrative shift is important as it has potential influence on external actors. In 1985 the Soviets have a new leader, and this could be the cause of the narrative shift; however, it is also plausible that the Soviet government is trying to stop the external support for the Mujahideen.¹⁷⁶ Following this political shift, there was a force surge in 1985 that increased offensive operations for nearly a year. However, this quickly feel off as there is a shift to end the war.¹⁷⁷ Some have also suggested the Soviets adopted a hearts and minds campaign in an effort to persuade the local populace to support the Afghan government.¹⁷⁸ The Soviets adopted a risk limited counterinsurgency campaign for the next three years, and seek political action within the international community. With the campaign shift, artillery was primarily used for defensive purposes, much as it had at the beginning of the war. Additionally, the air bombings become very limited, only

¹⁷⁴ Leshuk, *Stinger Missiles in Afghanistan*.

¹⁷⁵ Nelson, *Soviet Air Power: Tactics and Weapons Used in Afghanistan*, 30–44.

¹⁷⁶ Frank and Gillette, *Soviet Military Doctrine from Lenin to Gorbachev, 1915–1991*, 195–196. Loyn, *In Afghanistan: Two Hundred Years of British, Russian and American Occupation*, 151–152.

¹⁷⁷ Larry P. Goodson, *Afghanistan's Endless War: State Failure, Regional Politics, and the Rise of the Taliban* (Seattle, WA: University of Washington Press, 2012), 67–69.

¹⁷⁸ Olsen, *Air Power in Low-Intensity Conflict in the Middle East*, 9.

used as shaping operations for Afghan forces.¹⁷⁹ However, after five years of unrestricted bombing, this narrative shift did little to sway the existing opinion of the Afghan people. The Mujahideen continued to recruit fighters, and find safe houses with the Afghan community. Moreover, in 1987 the U.S. support for the Mujahideen still exceeds \$2.5 billion in value; therefore, no action was effective in removing the external actors support either.¹⁸⁰ Finally, in 1988 the Soviet Union has grown tired of the war in Afghanistan, and withdrawals from the conflict.

E. TECHNOLOGY UTILIZATION EVALUATION

The Soviet military was operating in a resource-limited environment, in a harsh mountainous region, against an irregular force with strong external support. Additionally, Soviet troops did not have much experience in counterinsurgency warfare. The Soviets military quickly finds a right-tech solution in the opening stages of the war, as this was mostly a conventional operation to neutralize the Afghan military. However, the war shifts from conventional to irregular as guerrilla fighters become their opposition. For the next five years the Soviets continued to operate as if they were still in a conventional war, and depended on innovation to overcome limitations. During this time, the Hind and Frogfoot were the primary strike aircraft, and the Cub was the primary lift and intelligence aircraft. The armored artillery was utilized for offensive operations, where towed and MRLS pieces were favored for shaping and defensive operations.

The Soviet military was successful in overcoming some technological limitations through tactical innovation. The Air Force innovated with the Hind by placing it into multiple roles which proved to be very effective. Their tactical innovation reduced the risk of being shot down, and initially increased weapons effectiveness. The Air Force also innovated with the Cub, using it to drop bombs. The Cub proved very effective as a strike aircraft, and enabled other offensive operations through this new role. The Soviet Army also found effectiveness in their armored artillery for offensive operations through

¹⁷⁹ Mark Urban, "Soviet Operations in Afghanistan: Some Conclusions," *Jane's Soviet Intelligence Review* 2, no. 8 (1990), 366–367.

¹⁸⁰ Baumann, *Russian-Soviet Unconventional Wars in the Caucasus*, 131–144.

tactical innovation. The Army was able to adjust artillery type and positioning to overcome identified defensive limitations of their MRLS artillery.

While these tactical innovations offered quick solutions to technology limitations for short term gains, they also decreased their effectiveness over the long run through attrition and miss-application. It would have been more effective to modify their weapons technology and training to coincide with the new tactics, or change weapons systems for better equipped technologies that addressed these shortfalls. Expanding the Hind's role decreased the reliability of the aircraft due to the increased stress on the airframe, and the associated maintenance costs. No testing was ever conducted on the Hind in this new tactical environment to fix any equipment deficiencies. Additionally, there was a shift to the Frogfoot due to new anti-aircraft weapons threats; unfortunately, it was not equipped with an advanced countermeasure system. More importantly, the Hind offered more mission flexibility and accuracy in this environment compared to the Frogfoot.¹⁸¹ It would have been more practical to equip the Hind with a more advanced countermeasure system and integrate it with well-developed tactics, than to shift to the Frogfoot.¹⁸² Another modification may have included increasing the strike capability of the Cub. The British and the U.S. militaries were operating a strike aircraft similar to the Cub airframe at this time; yet, the Soviets never developed this capability.¹⁸³ While the Soviets did utilize the Cub for bomb dropping, they did not develop any other strike system for this aircraft. This suggests the Soviets had focused only on conventional warfare aircraft systems integration.

Artillery could have been much more effective as well. Armored artillery became favored due to a lack of self-defense for the MRLS pieces against small arms fire. The

¹⁸¹ Table 9 in Appendix B clearly identifies the Hind as the flexible and accurate aircraft in the Soviet Afghan War. It also illustrates the fact that neither the Hind nor the Frogfoot were well equipped with ECM.

¹⁸² See Table 9 and Table 10 in Appendix B for complete technical analysis on aircraft utilized by the Soviet Union in Afghanistan. The technical analysis in the appendix clearly identifies the Hind as the more capable aircraft, and only needed minor modification to enhance its overall effectiveness as enemy technology shifted.

¹⁸³ Head, *Night Hunters: The AC-130s and their Role in U.S. Airpower*. Table 11 in Appendix B illustrates the capabilities of the American AC-130 used by the U.S. During this time and the airframe is near identical to the Cub.

technical analysis suggests they should have modified the MRLS pieces.¹⁸⁴ In fact, the Soviets had an armored vehicle with an integrated MRLS; however, it was never introduced in this conflict. Additionally, the data supports the 2B9 mortar system for defensive fires with its high rate of fire, and accuracy; however, the Soviets favored the MRLS pieces and towed artillery for this role. The MRLS units transitioned to this role due to their lack of defensive capabilities. The BM-21 Grad also needed minor modifications to make it more effective. It was well integrated in the artillery units, and was far more effective than the lumbering giants that resembled that of a tank; additionally, they could have requested the armored variant that was in service during this conflict. Finally, the Grad has a much lower operating cost compared to the heavy armored units utilized by the Soviets. The Grad became an underutilized defensive artillery when its mobility, accuracy, and high rate of fire clearly gave it an offensive advantage.

Ultimately, it was the unpopularity of the war, and its cost that led to the political decision to withdraw from Afghanistan. The Mujahideen managed to win by not losing.¹⁸⁵ With that understanding, one might argue that the Soviet Union technology level did not matter; however, this would be a false assumption.¹⁸⁶ The Soviets started this conflict with a large technological asymmetric advantage over the Mujahideen, but it gradually diminishes over the ten year conflict. The weapons technology utilized by the Mujahideen continually changes throughout this conflict, which was enabled by the support from external actors.¹⁸⁷ The Soviet forces in Afghanistan did very little to change their technology as the war continued, and instead relied on tactical innovation. While these innovations offered quick adjustments on the battlefield to overcome technological limitations, they failed to address the larger problem. By not adjusting their technology,

¹⁸⁴ See Table 3 and Table 4 in Appendix A for all artillery technical analysis. If the Soviet Army had access to the armored MRLS system in their inventory, no tactical innovation would have been needed to overcome technology limitations. Artillery units completely changed weapons technology utilized for each mission when it only required the substitution of one weapons technology.

¹⁸⁵ Lester W. Grau, "Breaking Contact without Leaving Chaos: The Soviet Withdrawal from Afghanistan," *Journal of Slavic Military Studies* 20, no. 2 (2007), 235–261.

¹⁸⁶ Leshuk, *Stinger Missiles in Afghanistan*, 11.

¹⁸⁷ Loyn, *In Afghanistan: Two Hundred Years of British, Russian and American Occupation*, 155.

either through modification or replacement, they failed to maintain a right-tech solution. Furthermore, the tactical innovation tended to strain the weapon systems they did have, ultimately increasing equipment failure and cost.

THIS PAGE INTENTIONALLY LEFT BLANK

V. IN-DEPTH CASE STUDY OF TECHNOLOGY STRATEGY IN THE UNITED STATES-AFGHAN WAR

Much like the other two case studies, the United States involvement in Afghanistan involved counterinsurgency warfare. U.S. intelligence personnel were collecting information within Afghanistan, and international involvement was attempting to limit Taliban or Al Qaeda acts of terror, but all these actions were preventative or defensive in nature until September 2001. Examining the historical facts leading to the United States war on terror within Afghanistan is important, as it will highlight limitations imposed on government agencies, such as the Central Intelligence Agency (CIA) and DOD by the U.S. government; furthermore, it will show how international involvement both helped and hindered offensive operations to potentially remove Afghanistan as a terrorist safe haven. Examining military doctrine and the artillery and aircraft technology the United States used in operations may highlight some successes and failures of their technology utilization and integration.

Much like the Soviet Union, the United States was able to remove any conventional threat to its military forces fairly quickly, and then found itself in a long irregular war that officially ended in 2014.¹⁸⁸ The United States developed an Afghan government and military partner force to assist with the Afghan campaign in an effort to stabilize the country; yet, they have not been able to achieve this due to guerrilla fighters and external supporters. The United States arguably is one of the most technologically advanced militaries, yet continues to struggle in preventing Afghanistan from returning to a terrorist safe haven. The U.S. military force in Afghanistan has been operating in a resources deprived environment; however, it has consistently fielded new weapons technologies throughout this conflict. The technologies provided to the allied forces were in an effort to limit risk to both civilian and military personnel, but not necessarily to limit resources. Unfortunately, these new technologies may not have increased military capability, and in some cases may have degraded capability. This failure to adjust to a

¹⁸⁸ CBS News, "U.S. formally ends the war in Afghanistan," Dec 28, 2014, (accessed Aug 23, 2015), <http://www.cbsnews.com/news/america-formally-ends-the-war-in-afghanistan/>.

right-tech solution may lead to the United States to withdrawing from Afghanistan without meeting its objectives.

A. AFGHANISTAN, THE TALIBAN, AND AL QAEDA

By February 1989, all Soviet forces had departed Afghanistan, yet the Najib Afghan regime it established was still in place. The supported guerrilla fighters soon had elections to claim leadership rights within Afghanistan; nonetheless, Najib was still running the country, and receiving aid from the Soviets. The Najib regime managed to hold on for three more years, and was finally overthrown April 15, 1992. Following the end of this communist based regime, the United States and Soviet Union mostly withdrew from Afghanistan, and regional powers became more involved. Pakistan, Iran, and Uzbekistan were the dominate actors during this time: “Inside Afghanistan, the extremist versions of Islam exported to Afghanistan from Pakistan, Saudi Arabia, and Iran now competed with each other and with the mild, indigenous Afghan Hanafi order.”¹⁸⁹ Ethnic and sectarian conflict consumed Afghanistan for the next nine years.

By the mid-1990s, Pakistan was sponsoring the Taliban and Al Qaeda organizations within Afghanistan. It has even been suggested that the Taliban was more than just sponsored, rather it was a proxy of Pakistan operating through the ISI.¹⁹⁰ The United States was interacting with Pakistan diplomatically, warning them they were in danger of being put on the U.S. terrorist list. Al Qaeda was added to the terrorist list in 1997, after receiving credible information of its involvement in embassy bombings, plots to assassinate the U.S. president, and potential links to the 1994 twin tower bombing.¹⁹¹ From 1998–2001, the CIA was operating covertly within the region in an attempt to capture Osama bin Laden.¹⁹²

¹⁸⁹ Peter Tomsen, *The Wars of Afghanistan: Messianic Terrorism, Tribal Conflicts, and the Failures of Great Powers* (New York, NY: Public Affairs, 2013), 484.

¹⁹⁰ Matt Waldman; *The Sun In The Sky: The Relationship Between Pakistan’s ISI And Afghan Insurgents* (Cambridge MA: Harvard University, 2010).

¹⁹¹ Lawrence Wright, *The Looming Tower: Al Qaeda and the Road to 9/11* (New York, NY: Random House, 2006), chapter 6.

¹⁹² Tomsen, *The Wars of Afghanistan: Messianic Terrorism, Tribal Conflicts, and the Failures of Great Powers*, 267–555.

B. GOING TO WAR

While there were multiple attacks by Al Qaeda operatives throughout the 1990s, the attack on September 11, 2001, would launch the United States into a “war on terror.” On this date, nineteen Al Qaeda operatives hijacked four domestic flights, and killed 2,973 people in just over an hour.¹⁹³ Following these attacks, the national security machine scrambled to understand and to retaliate against Al Qaeda. By the September attack, the CIA had established over a hundred sources within eight tribal networks in Afghanistan, and this would enable a quick U.S. response. The U.S. President approved CIA paramilitary teams to work with opposition forces, such as the Northern Alliance, within Afghanistan. These paramilitary teams paved the way for SOF teams, and enabled future airstrikes.¹⁹⁴

The President also approved a DOD four-phase plan that focused on eliminating Afghanistan as a safe haven for terrorist activity. The first two phases spanned the first three months of operations; phase three and four were much longer. Phase one focused on prestaging troops and assets, while the CIA conducted their initial operations. Phase two focused on SOF team integration, with CIA assistance, to direct precision aerial attacks. During phase one, other personnel continued to push the Taliban to separate itself from Al Qaeda; however, these efforts failed, and the Taliban were quickly added to the targeting lists. Finally, diplomatic efforts secured all necessary fly over permissions from various countries, and basing was secured in Uzbekistan, Oman, and the Persian Gulf. The CIA was able to insert its paramilitary teams by September 28, the air campaign was to begin October 7, and the SOF teams were to quickly follow.¹⁹⁵

October 7, 2001, the United States started its operational campaign within Afghanistan. The first night of operations struck thirty one predetermined targets utilizing air assets and cruise missiles.¹⁹⁶ Other air assets were utilized to jam enemy radar

¹⁹³ Barzilai, *102 Days of War: How Osama Bin Laden, Al Qaeda, and the Taliban Survived 2001*, 17.

¹⁹⁴ George Tenet and Bill Harlow, *At the Center of the Storm: My Years at the CIA* (New York, NY: Harper Collins, 2007), 175.

¹⁹⁵ Barzilai, *102 Days of War: How Osama Bin Laden, Al Qaeda, and the Taliban Survived 2001*, 20–42.

¹⁹⁶ *Ibid.*, 47.

systems and communications, and to provide a secure communications network for friendly forces. These operations were to establish absolute control of the air over Afghanistan through neutralizing the Taliban's air defenses. Targets included surface-to-air missile (SAM) sites, enemy air bases, and enemy aircraft. By the third day, air operations were being conducted during daylight hours, and the targeting list had expanded to include the Taliban military academy, enemy defensive artillery units, and possible training camps. By the fifth day, cave complexes were being bombed containing Al Qaeda personnel, and by the seventh night SOF air assets were finding and executing real-time targets. During this time troops and air assets were forward deployed to Uzbekistan, Oman, and the Persian Gulf in preparation for ground operations. These forward locations were needed to enable future SOF operations internal to Afghanistan. On October 17, the first SOF team was inserted into Afghanistan, and AC-130 aircraft attacked inhabited Taliban garrisons.¹⁹⁷ This was the beginning of phase two operations.

SOF personnel now acted as forward air controllers, and would positively identify target and clear aircraft for engagement. These forward air controllers were operating through Afghanistan, and a process was in place for the DOD and CIA to confirm all targets. Additionally, SOF aircraft were cleared to strike dynamic targets without the use of a forward air controller, and other air assets had a list of actionable targets enable by the SOF teams. By late October, forces would parachute into Kandahar and Mazar-i-Sharif and eliminate Taliban strong holds. Additionally, the Northern Alliance, with embedded SOF teams, would take the offensive securing Mazar-i-Sharif, Kunduz, and Kabul by late November. Finally, in late November, the first Forward Operating Base (FOB) was selected within Afghanistan, and approximately 1,200 conventional U.S. Marines were inserted to reinforce the SOF team that occupied this location. Up until this point, there were less than 200 U.S. personnel on the ground inside Afghanistan, and by December there would be multiple FOBs with operating air strips.¹⁹⁸ SOF teams continued to be vital during the Afghan campaign; yet, with the introduction of

¹⁹⁷ Benjamin S. Lambeth, *Air Power Against Terror: America's Conduct of Operation Enduring Freedom* (Arlington, VA: Rand Corporation, 2001), 80–93.

¹⁹⁸ *Ibid.*, 94–147.

conventional forces, the war moved into phase three, and the operations began to shift to a conventional international campaign.

C. DOCTRINE LIMITING RIGHT-TECH

In Chapter I, the review of current U.S. military doctrine discussed the gap in today's military's ability to integrate technology; additionally, it highlights the lack of a sound technology strategy. In fact, the preponderance of military and civilian leaders continued to push for high-tech solutions in the opening stages of this conflict, and the national security strategy pushed for high-tech solutions throughout the Bush administration.¹⁹⁹ Yet, some of the technology integration strategies limited or delayed operations in this conflict. While the United States did respond to the 2001 attacks in less than thirty days, the original planed response was delayed by more than a week.²⁰⁰ The U.S. had the capability to respond on its original planned time table; however, the military pushed for the delay based on other supporting technologies.

The review in Chapter II demonstrated the inconsistencies in U.S. understanding of irregular warfare. Historically, the United States' military branches have divorced themselves from irregular warfare following their withdrawal from this type of warfare.²⁰¹ The time period following the Vietnam conflict is a good example of this. During the Vietnam irregular war, the U.S. armed forces captured lessons learned, established new procedures, and founded new programs focused on learning about irregular warfare. However, following the withdrawal from this conflict, each service purged itself of these lessons.²⁰² Additionally, there was no direction for each military branch to maintain the ability to integrate SOF forces. While establishing SOCOM, to ensure Special Operations Forces are integrated has proven effective, each branch of the armed forces still has their own doctrine to govern activities, and outside of SOF each

¹⁹⁹ Bush, *The National Security Strategy of the United States of America*.

²⁰⁰ Barzilai, *102 Days of War: How Osama Bin Laden, Al Qaeda, and the Taliban Survived 2001*, 35.

²⁰¹ Alan J. Vick, Adam Grissom, William Rosenau, Beth Grill, and Karl P. Mueller, *Air Power in the New Counterinsurgency Era: The Strategic Importance of USAF Advisory and Assistance Missions* (Arlington, VA: Rand Corporation, 2006).

²⁰² Krepinevich Jr., *The Army and Vietnam*, 274–275.

military branch had difficulty operating jointly during the early years of the Afghan campaign.

Finally, the Air Force did not have doctrine addressing irregular warfare of any nature prior to 2007, with the exception of a joint Field Manual published in 1990, much less a strategy to integrate technology in this type of conflict. Moreover, *Air Force Doctrine Document (AFDD) 2–3*, dated 2007, did not use DOD or joint publications as a source for its definitions or methodologies covering irregular warfare. It was an air centric approach to irregular warfare, and technology integration, completely ignoring joint or combined operations. The Army was much the same way with its unified land operations doctrine published in 2011. This publication was more succinct with the joint publications than the Air Force; yet, it still had differing terminology and lacked direction for joint operations. More important, the definitions found in the joint publication were different, highlighting there was no clear comprehensive guidance across the different military branches.²⁰³

D. TECHNOLOGY USED ON THE BATTLEFIELD

In 2001, as the United States prepared to strike back at Al Qaeda and the Taliban, the Taliban controlled more than ninety percent of Afghanistan. The Taliban fighting strength was estimated at 45,000 troops. The Taliban weapon inventory included one hundred T-55 and T-62 tanks and other vehicles. They also had Soviet-made Katyusha rockets and some 80 armed helicopters. The Taliban did have some newer automatic rifles, machine guns, and mortars; additionally, intelligence suggested they may also have had some Scud short-range conventional ballistic missiles. Additional Taliban air assets included fewer than 50 MiG-21 and Su-22 fighter aircraft. Other intelligence reports hinted at an air defense network that included SA-3 SAM sites. Finally, their weapons inventory was assumed to include man-portable SA-7 infrared SAMs, anti-aircraft artillery (AAA) guns, and an undetermined number of U.S.-made Stinger shoulder-fired

²⁰³ United States Air Force, *Air Force Doctrine Document 2–3, Irregular Warfare* (Washington, DC: Department of the Air Force, March 15, 2007).

infrared SAMs.²⁰⁴ Most of these weapons systems were left over from the Soviet invasion of Afghanistan, and their operational status was most likely degraded, and not well integrated. As the Taliban have continued to receive support from external actors, it is possible that other weapons technology has been available to them.²⁰⁵

The United States military was limited to certain systems for multiple reasons. First, this was viewed as a limited war, and tailored toward terrorist organizations and those that support them. Additionally, Afghanistan is a land-locked country with harsh mountainous terrain. Mobility and agility influence weapons technology utilization within Afghanistan. Artillery is noticeably absent in the early stages of the conflict, and remains limited throughout the war.²⁰⁶ The United States military only employs four different artillery pieces throughout this campaign.²⁰⁷ Of these artillery pieces, there are two Howitzers, a 105mm and a 155mm. These Howitzers are the only gun-based artillery used by the United States. Mortar systems were also employed in Afghanistan to include the 60mm, and the 120mm. Artillery officers in the U.S. military do not consider mortars as part of artillery fires, however the 120mm mortar has been documented as an artillery replacement during this conflict, operated by artillery personnel. Therefore, it is included in the technical analysis.²⁰⁸ Finally, the HIMARS rocket based unit was used with significant capabilities and accuracy compared to the gun based pieces; however, this depends on rocket type used for employment.²⁰⁹

²⁰⁴ Lambeth, *Air Power Against Terror: America's Conduct of Operation Enduring Freedom*, 76–77.

²⁰⁵ Peter Wittig, *United Nations Security Council Report: Resolution 1988 (2011) Concerning the Taliban and Associated Individuals* (November 10, 2013).

²⁰⁶ Lester W. Grau and Dodge Billingsley, *Operation Anaconda: America's First Major Battle in Afghanistan* (Lawrence, KS: University Press of Kansas, 2011).

²⁰⁷ The artillery used by the United States includes: the M142 High Mobility Artillery Rocket System (HIMARS), the M119 105mm Howitzer, and the M777 155mm Howitzer. Some reports suggest the M198 155mm Howitzer, the predecessor to the M777, was also in this conflict; therefore, it was considered for discussion, but not in the technical analysis. Finally, for the purpose of this paper the M120 120mm Mortar will be included as artillery. The M777 is the newest variant, and replaced the M198 on the battlefield; therefore, the technical analysis only contains the M777. The major changes between the two 155 Howitzers is weight. Since the Army did not utilize any of the 155 Howitzers as mobile artillery the technical analysis would be near identical.

²⁰⁸ Joseph Jackson, "Moving Artillery Forward: A Concept for the Fight in Afghanistan," *Small Wars Journal* (2010), 9.

²⁰⁹ Ibid.

While the artillery and aircraft types were limited throughout this campaign, aircraft utilization was far less limited. Some sources have suggested over 30 types of military aircraft participated in the Afghanistan conflict.²¹⁰ Additionally, there were multiple civilian agencies providing aircraft and personnel that were performing military type missions.²¹¹ All aircraft that did not operate from within Afghanistan, such as heavy bombers and tankers, are not considered during the technical analysis. These aircraft were not subjected to the same operational environment as the aircraft operating from within Afghanistan. These aircraft were at a safe operating altitude prior to entering the combat zone, plus maintenance and logistics were conducted in a non-combat environment. Additionally, the contract aircraft are not considered either. The military contracts specified the required capabilities and it was up to the provider to do the rest.

Only considering military aircraft operations within Afghanistan, the United States military predominantly operated eighteen different types of aircraft throughout this war.²¹² Of these eighteen aircraft, the EC-130, EA-18G, EA-6B, MQ-1, and MC-12 are not included in the technical analysis. While they meet all the requirements listed above, their overall mission, and capabilities make it difficult to effectively analyze them in an unclassified environment. The remaining aircraft can quickly be divided into three different categories: lift, strike, and rotary-wing aircraft. Additionally, within each of these aircraft categories there are examples of low- to high-tech aircraft; however, some of their internal weapon systems may alter their overall technological sophistication. Furthermore, aircraft were operated by all branches of the U.S. military throughout the

²¹⁰ Federation of American Scientists, "America's War on Terrorism: Strategy and Weaponry," (accessed Aug 13, 2015), <http://fas.org/terrorism/str/index.html>.

²¹¹ Tim Shorrock, *The Afghanistan War Is Still Raging-but This Time It's being Waged by Contractors* (Washington, DC: The Nation, February 4, 2015) (accessed Aug 13, 2015), <http://www.thenation.com/article/afghanistan-war-still-raging-time-its-being-waged-contractors/>.

²¹² The aircraft used by the United States includes: the MQ-1 Predator, the MC-12W Liberty, the C-5 Galaxy, the C-17 Globemaster, the C-130 Hercules, the EC-130 Commando Solo, the AC-130 gunship, the A-10 Thunderbolt, the F-15 Strike Eagle, the F-16 Falcon, the EA-6B Prowler, the EA-18 Growler, the CH-47 Chinook, the UH-60 Black Hawk, the AH-64 Apache, the AH-1 Super Cobra, the OH-58 Kiowa, and the CV-22 Osprey. Of note, many of the missions internal to Afghanistan would not have been possible with the aircraft that have been removed from this study, but the technical analysis focus of environmental operations drives their exclusion.

war, and the aircraft technological level may have influence its ability to integrate into the overall campaign plan.

1. Artillery Technology

According to *ADRP 3-09*, field artillery is to defeat or disrupt enemy operations with integrated fires to enable successful maneuver commander operations.²¹³ The U.S. Army has divided artillery into four broad categories based on gun size: 120mm and below is light artillery, 121–160mm is medium, 161–210mm is heavy, and 211mm and up is very heavy; however, these do not include MLRS systems that are categorized as medium- and long-range systems. Finally, a Field Artillery Brigade (FAB) or Brigade Combat Team (BCT) may include one to five field artillery battalions, and each battalion may operate different artillery systems. An artillery battalion is generally around 200 personnel, and has five to eight artillery pieces depending on their type.²¹⁴ Within Afghanistan, towed artillery units were generally broke down to two gun units set up at FOBs, and larger units established at main operating bases.²¹⁵

Three of the four artillery pieces used in Afghanistan are towed units. Of these three artillery pieces, the M120 mortar is the only piece that breaks down small enough to maneuver on the battlefield without a tow vehicle. While it may be difficult for the five man team to maneuver fast and far with all their ammo, it is possible to quickly maneuver along offensive lines with a centralized ammunition location. The M120 is also the only smooth bore piece of artillery making it the least accurate, and has the shortest range. The M119A1 105mm Howitzer is the next smallest and lightest piece of artillery. This 105mm Howitzer can be air transported with all its ammo by a UH60 helicopter or two can be carried by a Chinook helicopter. It is capable of shooting more than double the range of the M120, but well less than the M777. While its range is short of the M777, the M119A1 has a wider range of elevation capabilities, making it the only gun with a negative slop setting. Finally, the M777 was the largest caliber gun, with the longest

²¹³ United States Army, *Field Artillery Operations and Fire Support* (FM 3-09) (Washington, DC: Department of the Army, 2014b), 1-1.

²¹⁴ Ibid., chapter 1.

²¹⁵ Jackson, "Moving Artillery Forward: A Concept for the Fight in Afghanistan."

range of any of the towed pieces. And while the M777 fare outweighs the M119A1, it is almost half the weight of the M198 155mm Howitzer. Additionally, the M777 is the most accurate of all three towed pieces, but has the slowest rate of fire.²¹⁶ Overall the M120 mortar and M119A1 are low-tech, and the M777 is medium-tech.

The M142 High Mobility Artillery Rocket System (HIMARS) artillery piece is the only self-propelled artillery utilized by the United States in Afghanistan. The HIMARS entered service in 2005, but is quickly well integrated piece of artillery. The M142 is a lightweight wheeled version of the M270 MLRS unit that had been in service since the early 1980s. They share the same weapons systems, jut different maneuver chassis. The wheeled unit's lighter weight makes in air lift able by an inter-theater aircraft like a C-130. Finally, the M142 offers general area bombardment with its smaller six missile ammo load, or pin point accuracy with the larger Army Tactical Missile System (ATACM); however, to switch between the two missiles is excessively time consuming.²¹⁷ The HIMARS artillery piece is high-tech during this conflict.

2. Aircraft Technology

The United States military tried to allocate air assets through mission requirements. Much like other countries, the U.S. military typically divides its aircraft by type: mobility, fighter, bomber, and ISR. Many of these aircraft have multi-role capabilities and do not fit into just one category; furthermore, there are mission requirements that are missing such as CAS and C2. Before examining the aircraft utilized by the U.S., it is important to understand how air assets are allocated. Most aircraft are control through the Combined Air Operations Center (CAOC). The CAOC controls allocation of aircraft for every military branch, and may include partner forces; thus, the CAOC is a joint, combined environment with its commander having the most air assets. The CAOC commander normally approves targeting lists, and allocates assets accordingly; however, this process was not followed holistically in OEF.²¹⁸ For other

²¹⁶ Federation of American Scientists, "FAS Military Analysis Network U.S. Land Warfare Systems," (accessed Aug 13, 2015) <http://fas.org/man/dod-101/sys/land/>.

²¹⁷ Ibid.

²¹⁸ Lambeth, *Air Power Against Terror: America's Conduct of Operation Enduring Freedom*, chapter 1.

mission types, organizations typically submit a Joint Tactical Air Request (JTAR), and aircraft are allocated based on requirements; however, many request specific aircraft, and this may not be the best fit based on capabilities. Finally, there are multiple aircraft that the CAOC does not control, like the AC-130 and many rotary-wing aircraft throughout OEF. Many aircraft remain allocated to specific units for direct mission control. While this may benefit these units, it may also hinder other operations, and limit the CAOC effectiveness.²¹⁹ Below is a comprehensive overview of each aircraft. For a complete capabilities review of each aircraft see Table 10 in Appendix B.

Most rotary-wing assets are internal to various units to enable rapid reaction to mission requirements. Lift specific rotary-wing aircraft include CH-47s, UH-60s, and CV-22s. All of the aircraft can provide limited CAS if required. The CH-47 is the oldest of these aircraft, with the lowest max altitude, slowest max speed, and requires the largest amount of space to land; yet, it has the most lift capability, and mission duration when loaded. The CV-22 has the next highest lift capability, has the highest altitude capability, and highest max speed. However, they suffered from limited availability and extensive maintenance problems.²²⁰ The UH-60 carries the least, with the shortest flight duration; however, it has the second best altitude and speed capability, and requires the least amount of support. The UH-60 and CH-47 are considered low-tech, and the CV-22 is high-tech. Strike or CAS specific rotary-wing aircraft include AH-1s, OH-58s, and AH-64s. The AH-1 has the highest altitude and speed capability, with the longest mission duration, and next best weapons load out. The AH-64 has the second best altitude, speed, and duration with the best weapons load capability. Finally, the OH-58 has the least altitude, speed, duration, and weapons load capability; however, it may offer the most mission flexibility. The OH-58 is low-tech, and the other two are medium- or high-tech depending on the variant.

Most mobility or fixed-wing lift aircraft are allocated by the CAOC. These aircraft include C-130s, C-17s, and C-5s. The C-130 is mainly used for intra-theater

²¹⁹ Phillip R. Pratzner Jr., “The Combined Air Operations Center: Getting the Organization Right for Future Coalition Air Operations” (Master’s thesis, Marin Corps University, 2002).

²²⁰ Mark Thompson, “V-22 Osprey: A Flying Shame,” *Time Magazine*, February 26, 2007.

cargo movement, followed by the C-17; additionally, the C-130 offers the most mission flexibility with the least support requirements; additionally, it has extremely limited runway requirements. The C-17 is the newest aircraft, and is heavily automated. It is capable of flying higher, and has limited runway requirements. The C-5 requires the most support due to its complicated landing gear; however, it can lift the most, with the longest mission duration.²²¹ The C-130 is low-tech, and the C-5 and C-17 are medium-tech aircraft.

The remaining aircraft are fixed-wing strike or attack aircraft which include: A-10s, F-16s, F-15Es, and AC-130s. Of these aircraft the AC-130 is the only one not controlled by the CAOC; additionally, has the longest flight duration, and can carry the most weapons load. However, until recently it did not have PGM capability, but is considered extremely accurate. The F-16 and F-15E are fast, with extreme altitude capability. Moreover, they potentially have the most mission flexibility depending on weapons load. However, both these aircraft have limited flight duration, require more ground support, and are airfield limited by runway conditions. The A-10 also benefits from high altitude capability, and relatively high speed; additionally it has the second best flight duration, and requires the least ground support. However, the A-10 is limited based on its weapons load, and sensor capabilities.²²² The AC-130 and A-10 are medium-tech, and the F-16 and F-15E are high-tech aircraft.

3. Military Operational Integration

In 2002, Phase Three of the U.S. campaign plan begins with an extensive conventional force buildup. As discussed, prior to 2002 there were less than 2,000 U.S. personnel within Afghanistan; however, by the end of 2002 there are over 5,000.²²³ Additionally, in March 2002, the U.S. launches its first large conventional military

²²¹ Federation of American Scientists, "FAS Military Analysis Airlift Cargo Aircraft," (accessed Aug 21, 2015), http://fas.org/man/dod-101/sys/ac/lift_comp.htm.

²²² Federation of American Scientists, "FAS Military Analysis Airpower Overview," (accessed Aug 21, 2015), [US Military Aircraft](http://fas.org/man/dod-101/sys/ac/airpower.htm).

²²³ Amy Belasco, *Troop Levels in the Afghan and Iraq Wars, FY2001-FY2012: Cost and Other Potential Issues* (CRS Report No. R40682) (Washington DC: Congressional Research Service, 2001), 9, <https://www.fas.org/sgp/crs/natsec/R40682.pdf>.

operation in Afghanistan. Operation Anaconda set the stage for much of phase three operations. The ground force conducted this operation without its normal artillery support; yet, they did have artillery personnel operating integrated mortar fires throughout the operation. While the mortar system mobility proved effective during this operation, its range limitations proved problematic. Air support was used as a gap fill for the ground force throughout this operation, and would remain a staple for all future operations.²²⁴ Unfortunately, the ground force did not include the COAC in planning for this operation, and the air components were only included at the last minute.²²⁵

AH-64 attack helicopters and AC-130s were the primary CAS platforms during Operation Anaconda. A-10 aircraft participated, but on a limited basis as they had just arrived in theater.²²⁶ Other assets were used for shaping operations, but they were very ineffective due to poor planning integration. Additionally, friendly fire incidents became problematic, for various reasons, for both fixed-wing and rotary-wing assets.²²⁷ Altitude and time on station was problematic for the AH-64, but this was compensated for with larger fleet support. Additionally, AC-130s were able to fill support gaps through extending their on target time.²²⁸ The additional gunship support was also possible because of number of aircraft availability. There were three times more gunships for CAS support throughout phase two and three as compared to phase four.²²⁹ However, the gunship support was also limited due to operating restrictions that remained unchanged till 2012.²³⁰ Finally, the COAC was able to redirect multiple aircraft in the area of responsibility (AOR) as emergency CAS was requested, and F-15Es and F-16s were able

²²⁴ Richard L. Kugler, *Operation Anaconda in Afghanistan: A Case Study of Adaptation in Battle* (Washington, DC: National Defense University, 2007).

²²⁵ Lambeth, *Air Power Against Terror: America's Conduct of Operation Enduring Freedom*, 182.

²²⁶ Gary Wetzell, *A-10 Thunderbolt II Units of Operation Enduring Freedom 2002-2007* (Long Island, NY: Osprey Publishing, 2013), 33–34.

²²⁷ Barbara Starr, "Report: Friendly fire killed U.S. soldier," *CNN Washington Bureau*, October 29, 2002. (accessed Aug 28, 2015), <http://www.cnn.com/2002/US/10/29/afghan.friendly.fire/index.html?s=PM:US>. Jonathan Bernstein, *AH-64 Apache Units of Operation Enduring Freedom and Iraqi Freedom* (Long Island NY: Osprey publishing, 2005), 16–17.

²²⁸ Bernstein, *AH-64 Apache Units of Operation Enduring Freedom and Iraqi Freedom*, 16–17.

²²⁹ Lambeth, *Air Power Against Terror: America's Conduct of Operation Enduring Freedom*, 80–93.

²³⁰ *Ibid.*, 189.

to quickly react to provide support.²³¹ Throughout the remainder of this operation the COAC was reactionary, and used multiple aircraft for support due the poor planning integration.

Using the lessons learned from Operation Anaconda, rotary-wing and SOF specific aircraft became the primary air support for ground operations during phase three. This is most likely because these aircraft were internal to those forces operating on the ground, meaning the ground force commander always had control and not the CAOC.²³² Additionally, ground operations generally included SOF for various reasons and with that came there direct air support units. The AH-64 attack helicopter was the primary rotary-wing systems for CAS during this time, and AC-130s were the primary fixed wing aircraft. The COAC still assigned a variety of aircraft for ground support, but they remained poorly integrated. Rotary-wing assets proved to be very effective for smaller operations during this time, however, their limited fight duration continued to be problematic. Additionally, reaching higher altitude locations was not possible during the summer months due to air density issues, and winter flight operations were limited due to severe weather conditions.

The U.S. continued to increase its overall force structure within Afghanistan and by the end of Phase Three in the summer of 2003 there were over 10,000 personnel in Afghanistan.²³³ With the increased force structure, the ground component is able to establish more FOBs, and artillery starts flowing into Afghanistan.²³⁴ The 105mm and 155mm artillery pieces start flowing into Afghanistan. These FOBs serve as a location where artillery can support all ground maneuver operations that have proven problematic to air assets.²³⁵ Artillery units are far more integrated into ground operations, especially

²³¹ Ibid., 190-191.

²³² Pratzner Jr., *The Combined Air Operations Center: Getting the Organization Right for Future Coalition Air Operations*.

²³³ Belasco, *Troop Levels in the Afghan and Iraq Wars*, 9.

²³⁴ Global Security, "Military Afghanistan Facilities," (accessed Aug 27, 2015), <http://www.globalsecurity.org/military/facility/afghanistan.htm>.

²³⁵ Marine Corps University, *U.S. Army Field Artillery Relevance on the Modern Battlefield* (Quantico, VA: Marine Air-Ground Training and Education Center, 2004).

in the planning phase, and this enables these units to rapidly react during combat operations as compared to air support units. Additionally, artillery can operate during weather conditions that will prevent effective air support and at altitudes where rotary-wing assets have difficulty operating. This ensures continuous fires during all operations. However, there are some severe limitations.

Mobility remained problematic for artillery, it limits their movement and effectiveness; additionally, accuracy becomes an issue at max ranges.²³⁶ Thus, most operations included air support, or had a quick reaction air asset assigned to it. This further complicated the environment for artillery units as they were not generally well integrated with air assets or with each other.²³⁷ Without detailed integration with air assets artillery fire may go through the altitude aircraft are operating, and this results in aircraft standing off from the target environment when artillery is active. Furthermore, artillery units are organized to integrate with a larger artillery system for effective fires; however, in Afghanistan artillery employment typically only included a couple guns and mortars, as compared to multiple artillery pieces staggered by size and range.²³⁸

In the summer of 2003, the U.S. campaign moved into Phase Four and NATO takes the helm in Afghanistan as the U.S. shifts multiple assets to Iraq.²³⁹ This does not mean the U.S. reduced its strength in Afghanistan, on the contrary the number of U.S. personnel continued to grow every year through 2011.²⁴⁰ However, the SOF and air assets were split between Afghanistan and Iraq. As a result, SOF organizations were not well integrated with the growing number of conventional forces. This limited gunship availability within Afghanistan, and from this point forward they only supported SOF. Additionally, the growing conventional force was forced to rely on the CAOC to provide

²³⁶ Jackson, "Moving Artillery Forward: A Concept for the Fight in Afghanistan."

²³⁷ Marine Corps University, *U.S. Army Field Artillery Relevance on the Modern Battlefield*, chapter 3.

²³⁸ Stephen J. Maranian, "Field Artillery Fires in the Mountains of Afghanistan," *Field Artillery Journal* (2008), 34–36.

²³⁹ North Atlantic Treaty Organization, "ISAF's Mission in Afghanistan 2001-2014," (accessed Aug 27, 2015), http://www.nato.int/cps/en/natohq/topics_69366.htm.

²⁴⁰ Belasco, *Troop Levels in the Afghan and Iraq Wars*, 9.

air support. The CAOC fills these growing support requests with what was available and for Afghanistan that meant A-10s, F-16s, F-15Es and B-1B aircraft. Of these aircraft, the technical analysis clearly indicates the A-10 as the best platform; however, it only provides nineteen percent of CAS support throughout this phase.²⁴¹ In fact, the F-16 provided nearly double the amount of CAS support, and the F-15E provided nearly the same amount of support as the A-10.²⁴²

Prior to entering Phase Four, the CAOC, SOF organizations, and conventional forces managed to find an effective right-tech solution with air assets. Additionally, with overall operational integration the artillery units were slowly taking shape. As the political and military priorities shift to Iraq, this is no longer the case. The statistical data above was from 2006 to 2013, further highlighting this as a phase four failure to find a right-tech solution.²⁴³ Phase three had many more gunships, and quickly introduced A-10s into the AOR. The F-15E was also operating internal to Afghanistan during phase three and four, but the A-10 units oversaw operations during phase three. During phase four this shifts to F-15Es as they made up one third of the CAS asset available from the CAOC, highlighting the deviation from a right-tech solution. Furthermore, air assets throughout phase four continued to be reactionary, and poorly integrated as the CAOC tried to manage two different AORs. This finally changes with the F-15E withdrawal from Afghanistan at the end of 2012. The A-10 takes center stage with the CAOC internal to Afghanistan, and they start to re-integrate with ground users now that air support is becoming more limited.²⁴⁴

During Phase Four of operations new artillery is introduced. The U.S. military deploys the M777 155mm, and HIMARS rocket based artillery during this time. The M777, as mentioned earlier, is much lighter and slightly more accurate than the M198

²⁴¹ See Table 11 and Table 12 in Appendix B for details. The A-10 is clearly more capable based on waited capabilities.

²⁴² Aron Mehta, "Air Force, lawmakers clash over future of A-10 again," *Military Times* (April 29, 2014) <http://www.militarytimes.com/article/20140429/NEWS05/304290069/Air-Force-lawmakers-clash-over-future-10-again>. See Table 10 and 11 in Appendix B for detailed analysis.

²⁴³ Ibid.

²⁴⁴ Wetzel, *A-10 Thunderbolt II Units of Operation Enduring Freedom 2002–2007*, 33–34.

gun it replaced. Additionally, the two guns shared the same ammunition, so no new supply requirements manifested from this artillery shift. What is significant is the ability to air lift the lighter M777 plus more ammunition with rotary-wing assets. As mission priorities shift, these artillery units are better suited compared to its predecessor.²⁴⁵ The HIMARS artillery system brings a whole new artillery capability to Afghanistan during this time. This was the only rocket based system utilized in Afghanistan by the U.S.; additionally, it was the only one that offered precision munitions at the time.²⁴⁶ However, the weapons system was new to the operators, and was not well integrated. It was even suggested that the Air Force's ability to support ground operations negated having the HIMARS artillery in Afghanistan.²⁴⁷ Finally, the HIMARS does not offer close in support like the gun based artillery. While the HIMARS long range capability enables a great standoff capability, it stands to reason it cannot be used for self-defense missions.

In 2012, the military starts to shift back to a SOF centric strategy.²⁴⁸ For this analysis, the strategy of SOF vice conventional is of little importance; what is important is the balance of force and technology. With SOF unit numbers increasing, and conventional forces decreasing, complete force integration reemerges. From an air asset and technology perspective, the Air Force is able to return to a right-tech solution with the A-10s taking center stage for the CAOC, and gunships increasing with the increased SOF presence. Additionally, over this long war the gunship and A-10 fleets have been modified to include precision munitions, and better fire control systems.²⁴⁹ These modifications have enabled these platforms to better integrate with the military campaign planes, further highlighting them as a right-tech solution. Other platforms also see significant modifications to increase operational capability. A good example of this is the

²⁴⁵ Maranian, "Field Artillery Fires in the Mountains of Afghanistan," 34–36.

²⁴⁶ Federation of American Scientists, "FAS Military Analysis Network U.S. Land Warfare Systems," (accessed Aug 13, 2015), <http://fas.org/man/dod-101/sys/land/>.

²⁴⁷ Marine Corps University, *U.S. Army Field Artillery Relevance on the Modern Battlefield*, 25–29.

²⁴⁸ Shanker, and Schmitt, "US Plans Shift to Elite Units as it Winds Down in Afghanistan."

²⁴⁹ United States Air Force, "Air Force Aircraft Fact Sheets," (accessed Aug 30, 2015), <http://www.af.mil/AboutUs/FactSheets.aspx>. Alex Quade, "The Gunship American Special Forces Use To Fight Terror" *Daily Caller* (2015), (accessed Aug 30, 2015), <http://dailycaller.com/2015/08/30/federal-court-finds-due-process-violation-in-ny-countys-confiscated-gun-policy/>.

newest AH-64E. It has upgraded engines and rotor blades that enable the attack helicopter to have a quicker response time and longer time-on-target capability.²⁵⁰ Another example is the Precision Guidance Kit (PGK) for the gun based artillery shells. The PGK for both Howitzers used in this conflict enable accuracy within ten meters at all possible ranges.²⁵¹

Finally, in 2014 the U.S. announces the end of the war in Afghanistan, concluding phase four operations. This does not mean all U.S. troops have left Afghanistan. What it does appear to mean is the U.S. is shifting to a SOF centric approach, which will assist the Afghan military units through training and other various activities.²⁵² The specifics for this shift in operations are still unclear, but the U.S. military continues to field various technologies it views will help keep Afghanistan stable.

E. TECHNOLOGY UTILIZATION EVALUATION

The U.S. military was operating in a resource limited environment, in a harsh mountainous region, against an irregular force with substantial external support. Additionally, in 2001, the U.S. military was not well prepared for an irregular war, as they had limited doctrinal guidance on irregular warfare. Due to overwhelming pressure from the White House, the military, with CIA assistance, was able to quickly respond following the September attack in 2001. The initial response appeared to be conventional with an Air Force standardized approach to removing any air defense capability. This was one of the primary missions for the Air Force, and they quickly eliminated this threat through overwhelming force.

The operations in Afghanistan quickly became SOF centric with CIA assistance. SOF teams were able to enlist help from the Northern Alliance, and started calling in air strikes on dynamic targets. Additionally, SOF centric air assets started operating

²⁵⁰ Brendan McGarry, "Army's New AH-64E Apache Surprised Enemy in Afghanistan," *Military* (January 28, 2015). (accessed Aug 31, 2015), <http://www.military.com/daily-news/2015/01/28/commander-armys-new-ah64e-apache-surprised-enemy-in.html>.

²⁵¹ Audra Calloway, "PGK Arrives in Afghanistan Ahead of Fighting Season," *Picatinny Voice* 26, no. 8 (April 19, 2013).

²⁵² Mark Thompson, "U.S. Ends its War in Afghanistan," *Time Magazine*, December 28, 2014.

autonomously throughout the AOR, and effectively eliminated targets of opportunity. From 2002 through 2003, SOF and conventional forces are able to integrate effectively, and find a right-tech solution.

Unfortunately, when the United States shifted priorities to Iraq, much of the success in Afghanistan started to disintegrate. The right-tech solution was lost through shifting priorities and not following established support requests. Air support becomes reactive instead of proactive. While artillery starts to take shape during this time, it never fully integrates with the supported users. They are able to find a right-tech solution within the mountainous battle space; however, this is only true when there is no integrated air support. Artillery almost became a substitute for air support when weather or environmental conditions prevented air support. What really proves effective is the mortar systems used by artillery personnel with integrated air support. However, artillery personnel do not consider mortar systems artillery, and never really seek to develop this successful integration into a standard operating procedure.

Following the United States reprioritization in Afghanistan, air support may once again be able to find a right-tech solution. Additionally, many technologies that have had difficulties operating in this environment have been modified to make them better suited for these operational conditions. The U.S. military clearly has an effective weapons technology program to update existing integrated weapons systems. Some of these changes are quicker than others, most likely because they are utilizing off the shelf technology. In other words, no new technology has been developed. The modified A-10, AH-64E and light weight artillery are good examples of modified technology; however, it has not been a rapid process. New technologies, like the PGK, have been slow because of development issues. Ultimately, over the fourteen year war, the U.S. military is able to find a right-tech solution, twice. Unfortunately, the U.S. military is unaware of their successful technology integration.

THIS PAGE INTENTIONALLY LEFT BLANK

VI. CONCLUSION

During the course of this thesis, the literature review showed there are multiple theories about technology utilization in conventional warfare, but a gap exists in theories about technology in irregular warfare. The three case studies suggest that these technologically-developed militaries were each able to appropriately respond to conventional threats with the correct weapons technology. All three powers faced some form of conventional threat during their conflicts, and were able to dominate that portion of the campaign. However, in each conflict, the irregular actors remain problematic for all three technologically developed militaries. Furthermore, there are examples of all three strong actors trying to overwhelm their enemy with technological superiority, and ultimately operating inefficiently as they did not utilize technology based on capability. Additionally, the technology that was non-capability driven provided the enemy with exploitable gaps in technology, and reduced the strong actor's asymmetric advantage.

The technology evaluation for each case study has identified three overarching issues with technology utilization in irregular warfare: failure to identify requirements, poor technology integration, and poor technology modification processes. First, it is essential for commanders to identify required capabilities based on environmental conditions and objectives in irregular warfare. Unfortunately, this is not how developed militaries typically engage an irregular enemy, and ultimately waste resources. Once the best weapons technologies have been identified tactical and technological innovation were generally able to fill any capability gap. However, this is only true with medium- and low-tech weapons systems. Medium- and low-tech weapons systems are generally better integrated into the force structure, and this enables the tactical and technological adjustments for operational gaps. Finally, in order for tactical and technological innovations to be successful, there must be an established process to produce the required changes in a timely manner to eliminate any capability gap. Tactical changes will need to be addressed through tactics, techniques and procedures (TTP) analysis, and technology innovation should be addressed through a rapid acquisition program for off-the-shelf-technology. Addressing these short falls in doctrine, resource allocation processes,

tactical innovation analysis processes, and acquisition processes will enable an effective irregular warfare technology strategy.

A. CHANGES TO DOCTRINE

To enable a successful technology strategy in irregular warfare, it must be addressed in the military doctrine. The U.S. Air Force doctrine is the only irregular warfare doctrine of all American military thought to highlight the shortcomings of technology strategy in this type of conflict, and this provides a foundation to build on. *AFDD 3-2* goes on to say “Both high and low technology assets have applicability in IW. Commanders should understand the appropriate technology to apply to the specific operational or tactical problem.”²⁵³ However, this guidance is poorly placed, and hard to interpret. It does not address the true problem, a lack of technology integration strategy. This should be modified to include all technology, and needs to direct commander to act based on needed capabilities. The Air Force has already assumed commanders are familiar with specific technology capabilities, but fails to direct them to follow a capability based approach. I would recommend changing this verbiage to read:

All technology assets have applicability in IW based on required capabilities. Commanders need to outline required capabilities based on specific operational and tactical problems. These capabilities will be priorities and used to identify the appropriate weapons technology for operational integration. Finally, commanders need to identify any remaining capability gaps based on technology resources provided.

This guidance gives commanders clear direction to enable effective technology utilization; yet, it will also give them the flexibility to determine the process for implementation. At a minimum, this direction needs to be included in *JP 1*, *AFDD 3-2*, and *ADRP 3-0* to ensure the entire DOD develops a sound technology strategy in irregular warfare. Additionally, this is not an all-inclusive list of doctrinal manuals that should contain this information; it represents a foundation so each service can adjust based on the changing technological resources and the operational environment.

²⁵³ United States Air Force, *Air Force Doctrine Document 3-2, Irregular Warfare*, 11.

Additionally, for a technology strategy to be effective, each military organization needs clear concise irregular warfare guidance or doctrine. The Navy continues to play a critical role in irregular warfare; however, they do not have an irregular warfare doctrine. The most recent guidance the Navy offers is their Irregular warfare vision statement from 2010, and it is extremely misaligned with joint irregular warfare doctrine.²⁵⁴ Additionally, the Air Force and Army irregular warfare doctrine, while better aligned with the joint publication, does not command clear guidance. Much of the terminology is vague leaving operational commanders guessing at the true operational intent. *JP 3-05*, and its associated annexes, is much better at identifying mission roles and expectation for irregular warfare. This doctrine is specific to special operations; yet, offers each of the services an example of clear irregular warfare doctrine.

B. CHANGES IN PROCESSES

There are three processes that need further consideration to enable a successful technology strategy that is built on doctrinal guidance. Organization need to develop a capabilities-based approach to allocate resources. Once resources have been allocated and employed in the operational environment, operators will discover system or operating limitation that will inhibit their capability or effectiveness. Some of these limitations may be addressed by changing operating procedures, or tactics. However, the case studies have shown that changing tactics may lead to more accidents and maintenance, as was the case with the Hind. Thus, it is important to develop a process to test new tactics to ensure they are safe, and to include them in normal training operations. Finally, operators and commanders will discover operating limitations that can only be addressed through technology. For example, the operating environment might affect radio communications, and a better radio might fix the problem. This fix requires technology modification, and faster is better for the combat environment is constantly changing.

²⁵⁴ Ronald O'Rourke, *Navy Irregular Warfare and Counterterrorism Operations: Background and Issues for Congress* (CRS Report No. RS22373) (Washington, DC: Congressional Research Service, 2015), <https://www.fas.org/sgp/crs/natsec/RS22373.pdf>.

1. Change in Resource Allocation Processes

Each military branch needs to develop a capabilities-based process for operational support from external units or organizations. While some of the current support request processes consider capability, it also allows for commanders to request specific weapons systems. This should only be authorized when operational integration is dependent on a specific technology. Additionally, the current process is inefficient and creates vulnerabilities through technology mismanagement leading to gaps in operational capabilities. The attached appendices provide an example of a capabilities-based process; however, they are limited in nature. The process used for this thesis is based on resources that have already been provided to combat commanders, and would be available to forward operating organization such as the CAOC to manage. The request process needs to move beyond this type of technology management. These organizations should have resources to allocate based on previously identified required capabilities, and they need the ability to rapidly acquire any additional resources that will remove an operational gap based on overall capability. Finally, this process should also allow combat commanders to identify resources that are no longer needed based on environmental or operational changes to expedite their re-deployment back to home station. To facilitate this process, combat commanders need access to a capabilities matrix maintained by each military organization. This will help combat commanders quickly identify required resources, and identify any gaps in capability.²⁵⁵

2. Change in Tactical Analysis Processes

Each case study has examples of tactical innovation to overcome weapons technology limitations, and the British and U.S. militaries have examples of weapons technology modification based on the capability limitations that led to innovation. More importantly, weapons technology that is not modified following a tactical change tends to have a shorter life cycle, ultimately limiting availability and increasing cost. The shorter

²⁵⁵ Both Appendices use a capabilities matrix, see all twelve tables, to identify resources or technologies based on overall capability and flexibility. This may be used as a foundation for future technology integration strategies to ensure the desired capability is available to military members in combat.

life cycle is due to increased wear on the weapon system, increase operational risk leading to accidents, or both. Having a tactical analysis program identifies these new vulnerabilities based on the new tactics, and ensures complete weapons technology integration.

The Air Force has a tactics program, that begins at the unit level, operating through each major command, and finally culminates with complete force integration. This program functions through a tactics unit within every air wing, and through the weapons school attached to every major command.²⁵⁶ Tactics units take inputs from all operational units within their wing, and work to integrate new tactics quarterly. The Weapon School maintains responsibility for training operators to be experts in their weapons systems. Additionally, the Weapons School and tactics units work together for major tactical changes to operating procedures, and integrate these changes with all major commands. Finally, the major command operational office oversees the entire program, and integrates it with major command testing units. These testing units ensure the weapons systems are not operating under conditions that will cause system failure. If the test unit identifies possible issues, potential weapon system modifications are highlighted. Of the armed forces, this program appears to be the most effective as the Air Force major commands have mission overlap. The other services tend to divide areas of responsibility due to mobility restrictions, and do not effectively integrate in this manner. This can serve as a foundation for the other services.

While this tactics integration system is effective, it does have some limitations under its current construct. First, large major commands have overly complex process due to geographic separation, and weapons systems diversity. Second, there are too many internal agency integration requirements for tactics to be officially changed. If the process is too cumbersome, operators may start performing tactics without following the established process. This was the case for the Soviet military in Afghanistan, and that is why there were so many accidents. The agencies required for an expedited tactics

²⁵⁶ The Air Force has several major commands and not all need to maintain these programs. The commands that need this include: Air Force Special Operations, Air Combat Command, Air Force Global Strike Command, Air Force Mobility Command, and Air Force Space Command.

integration program are those listed above; however, this does not represent all the extraneous units or agencies that are involved in this process. Each command needs to evaluate their processes, and remove steps that will facilitate tactics innovation while maintaining system and operator safety.²⁵⁷ At least one command has put time limitations on the process for a tactical change or recommendation to go through the complete process, and eliminates many internal agencies based on requirements.²⁵⁸ This enables any operator or commander to quickly determine the amount of time for recommended changes. This needs to be the standard across the military services.

3. Change in the Acquisitions Processes

All three case studies provide examples of technology modification through a process that made fielded weapons systems more capable, or a failure to modify weapons technology leaving a gap in capability. Additionally, it appears that the more advanced systems take longer to modify. For example, the British were able to modify aircraft with previously developed camera and communication systems in just a few months; yet, the U.S. military appears to need between five to ten years to modify its weapons technology. The Soviets simply used its weapons technology to failure and replaced it. Both the Soviet and the U.S. process of adjusting technology on the battlefield left them vulnerable to capability gaps, and it most likely increased the overall cost of the conflict.

In 2009, the Defense Science Board report to the Secretary of Defense states the “DOD lacks the ability to rapidly field new capabilities for the warfighter.”²⁵⁹ Additionally, the attached memorandum says “[t]he report cites a number of institutional barriers to rapid fielding of proven technologies.”²⁶⁰ In other words, six years ago the

²⁵⁷ While it would be better for these processes to be streamlined throughout each service for all operations, it may be necessary to first streamline the process for weapons systems operating in a combat environment.

²⁵⁸ Secretary of the Air Force (SAF/OS). *AFSOC Weapons and Tactics Program*. Instruction, Air Force Special Operations Command 11–207. Washington, DC: Secretary of the Air Force (SAF/OS), April 8, 2015.

²⁵⁹ Under Secretary of Defense (AT&L), *Defense Science Board Task Force, Fulfillment of Urgent Operational Needs*. Washington, DC: Under Secretary of Defense (AT&L), July 2009, 2–9. <http://www.acq.osd.mil/dsb/reports/ADA503382.pdf>.

²⁶⁰ Ibid., Attached MFR.

Secretary of defense was given a report stating the acquisition program was broken, and outlined steps to fix the problem. These steps included using proven technology, suggesting the use of medium and low level technologies, and a new rapid acquisition process that would operate independent of the current acquisition process. The report clearly highlights the benefits of the current process for new developing high-tech weapons systems, and suggests there are many lower level proven technologies that can be rapidly fielded to modify existing weapon systems to increase their overall capability.

To date, SOCOM is the only organization to implement a rapid acquisition program.²⁶¹ SOCOM started their rapid acquisition process shortly after the above report was published. Their process has proven so effective that new equipment has been fielded in under seven days, Unmanned Air Vehicles have been fielded in fourteen weeks, and a new weapons system was fielded in under six months.²⁶² *SOCOM Directive 70-1* outlines their acquisition program and process, and it follows the suggested methodology from the above report. This is a proven process that can be tailored by each military service to establish a rapid acquisition process. This process has the ability to enable new warfighting capabilities based on low and medium technologies, and their rapid fielding programs.

C. SUMMARY

This study has examined the use of technology in irregular warfare to help understand the strategic benefits offered by most levels of technology. In reviewing existing theories of technology in warfare, there is clearly a gap regarding technology strategy in irregular warfare. Additionally, some scholars believe environmental conditions of a given situation may lead to the misapplication of technology, and their analysis of the environment is based on simplicity and stability.²⁶³ By understanding the difference between a simple and complex environment—and a stable and unstable

²⁶¹ Tim Troup, "Acquisition Truths from the Trenches," *Defense AT&L Magazine*, May-June 2010.

²⁶² *Ibid.*, 42.

²⁶³ These scholars include, but are not limited to, Biddle, Van Creveld, Boot, Rubright, and Wintringham all covered in the literature review; however, they tend to focus on conventional warfare, or the evolution of technology, and not technology strategy in irregular warfare.

environment—it is possible to determine the correct level of technology that could enable success in irregular warfare.

This research has focused on identifying the proper use of technology in irregular warfare by examining the impacts of doctrine and on-the-ground decisions related to the use of technology. Accompanying the case study approach, an in-depth technical examination of artillery and aircraft utilized during each conflict studied offers insights into how technology influenced the decision to employ certain equipment over others to counter irregular opponents. In short, this study attempted to identify where the strong actor went awry in its use of technology during an irregular warfare campaign, and recommend technological strategy changes that may close the gap in needed operational capability. Through implementing the changes to doctrine and a variety of processes outlined in this chapter, military leaders can develop an effective technology strategy for waging irregular warfare. Moreover, if these changes are adapted, fewer resources will be needed, less risk will be assumed, and overall capability will increase.

APPENDIX A. ARTILLERY

A. THE MISSION IN IRREGULAR WARFARE

Joint Publication (JP) 1 defines irregular warfare, and *JP 3-0* governs joint operations. *JP 3-05* governs all special operations through SOCOM with annexes for each military branch components, and it further expands on missions associated with irregular warfare.²⁶⁴ Additionally, the Air Force and Army service specific doctrine sites *JP 1*, *JP 3-0*, and *JP 3-05* for much of its information and definitions governing operations in irregular warfare. Finally, Army component commanders and staff can refer to *Army Doctrine Reference Publication (ADRP) 3-0*, and *ADRP 3-05* for guidance in irregular warfare. As the focus of this thesis is technology in irregular warfare, the mission set listed below was used for making assumptions, and listing mission priorities. Each commander has the ability to shape these priorities as the mission and environment changes to enable a right-tech solution.

ADRP 3-05 summarizes the role SOCOM plays in irregular warfare, and differentiates U.S. Army responsibilities from U.S. Army Special Operations Command (USASOC) responsibilities. Additionally, *ADRP 3-05* outlines all mission sets that may be applicable in irregular warfare that are found in national law or title 10, DOD Directives, SOCOM publications, and Joint Doctrine.²⁶⁵ Finally, *Field Manual (FM) 3-05* differentiates between the strategic, operational, and tactical levels of operation. At the tactical level, *FM 3-05* outlines responsibilities based on offense, defense, and stability actions.²⁶⁶ These mission sets were the primary factors when considering artillery in irregular warfare. Moreover, *FM 3-05* directs all U.S. Army personnel to follow this manual and mission sets in irregular warfare; thus, this may be transferred to conventional units, not just Special Operations Forces. Finally, *FM 3-0* utilizes the same

²⁶⁴ United States Joint Chiefs of Staff, *Joint Publication 3-05, Special Operations*. Washington, DC: United States Joint Chiefs of Staff, July 16, 2014.

²⁶⁵ United States Army, *Army Doctrinal Reference Publication 3-05, Special Operations*, Washington DC: Department of the Army, August 31, 2012, 1-2.

²⁶⁶ United States Army, *Army Special Operations Forces (FM 3-05)* (Washington DC: Department of the Army, 2014), 1-4.

offensive, defensive, and stability operations organization as *FM 3–05* with some of the same information in irregular warfare; however, it does not fully explore the irregular warfare mission set like that found in *FM 3–05*.²⁶⁷

It is up to the overall campaign commander and ground component commander to outline the requirements for artillery assets based on the mission and environment. After consulting this doctrine and several experts in this field at the command level, one way to outline these requirements is through stacking priorities. As an example, a commander may develop priorities based on missions such as shaping, defensive, and offensive. Once missions are decided on, the commander and staff will stack priorities based on capability. For the shaping category, an example of stacked priorities might include deliver a high volume of ammunition, followed by coordinated fires, long range, very mobile, and finally require little maintenance. Once completed the raw data is mathematically weighted by the commanders stacked priorities.

Prior to weighting the commander's priorities, it is necessary to categorize or bin each artillery capability for comparison and analysis. Each case study has a table that highlights specific capabilities for each piece of artillery that was available for use. This data has been divided into three main categories for overall ranking to include mission flexibility, operational environment, and required support. The mission flexibility category shows the adaptability of a weapons technology on the battlefield as the mission changes. Artillery with multiple ammunition types, designed for different targets, have adaptability; thus, the more ammunition types an artillery piece has the more flexible it is. These ammunition types make up the sub-categories for mission flexibility. The operational environment involves the terrain, the weather conditions, and the tactical operations of opposing forces. Terrain and weather are re problematic in this thesis due to extrema elevation changes in the mountains, cold weather, and the state boards. Tactical operations of opposing forces are either conventional of irregular, and this thesis focuses on irregular. The sub-categories are technical details for each artillery weapons system effecting its capability in the operational environment: range, elevation, rate of fire,

²⁶⁷ United States Army. *Operations* (FM 3–0) (Washington DC: Department of the Army, 2008), chapters 1 and 2.

weight for mobility, and miss distances. Required support and capability refers to number of operators, maintainers, and overall reliability of the weapons systems.

Many of the sub-categories can be directly transferred to the commander's priority tables like the rate of fire; however, some of the priorities must use multiple sub-categories to form the weapons systems ranking. An example of this is flexibility. The commander priority list has flexibility as a requirement, but this is not a listed capability like range or rate of fire. Therefore, multiple sub-categories must be combined to form a flexibility score. In this example all the ammo types available formed the flexibility composite score. Furthermore, if multiple artillery pieces share the same composite score based on ammo type, then gun degrees of elevation and traverse capability is factored into the overall score. Finally, many sub-categories listed in the raw data tables use a number system between zero and one to define capability. Zero or N/A means that weapons technology does not have the capability for that sub-category; one means it is fully capable, and number score in between one and zero is partially capable.²⁶⁸

Once all priorities are established, all available artillery pieces are determined, and all artillery capabilities are outlined for comparison, the raw data can be populated based on ranking.²⁶⁹ For example, the raw data suggests the QF 18-Pounder Gun has the highest volume or rate of fire, and the BL 60-Pounder Gun has the lowest volume or rate of fire; therefore, the QF 18-Pounder Gun is ranked number 1 of 6, and the BL 60-Pounder Gun is number 6 of 6.²⁷⁰ All remaining artillery pieces are ranked somewhere in between. Additionally, the stacked commander priorities are given a score to enable the waiting process. The highest priority is given a score of 1, and the lowest priority receives a score of 5 since that is all the listed priorities for this example. Once this is complete, a weighted score is developed by multiplying the artillery ranking scores by the score value assigned by the commanders' priorities and added up. The formula for weighting each capability is as follows: (required capability*commander priority

²⁶⁸ Tables 1, 3, and 5 contain the raw data outlined in this paragraph. Table 1 is the British case study, Table 3 is the Soviet case study, and Table 5 is the U.S. case study raw data for each artillery piece.

²⁶⁹ See the upper right corner of Table 2, Table 4, and Table 6 for commander priorities for each case study. For this paper, each table shares the same commander priorities. Additionally, there is a table for each case study with the basic capabilities of each piece of artillery, or the raw data.

²⁷⁰ See Table 1 for rate of fire, and Table 2 for ranking based on rate of fire.

ranking). Once each capability is multiplied by the commander's priority ranking, all five scores are added up for their total score for final ranking.

For example, the QF 13-Pounder Gun, in the Third Anglo-Afghan War case study, has three different scores based on mission: 41 for shaping operations, 54 for defensive operations, and 51 for offensive operations.²⁷¹ Using the formula outlined above, the QF 13-Pounder Gun shaping formula is: (volume*priority 1) + (FDC*priority 2) + (ranger*priority 3) + (range*priority 4) + (reliability*priority 5) = score.²⁷² In number form this looks like (2*1) + (3*2) + (5*3) + (2*4) + (2*5) = 41. Once each artillery piece has been weighted based on commander's priorities, each artillery piece is ranked where the best artillery gets the lowest score and the worst gets the highest score. The QF 13-Pounder Gun score of 41 is second best as the QF 18-Pounder Gun has a better shaping score.²⁷³ This process is repeated for the other two missions based on commander's priorities.

Finally, several assumptions have been stipulated for the culmination of this data. First, the artillery environment focuses on conditions important to Afghanistan, the eastern frontier, and the difficulty of maneuvering in the region. Additionally, the mountainous terrain effected setup and resupply conditions in addition to mobility. Second, ammunition enables artillery adaptability. The more ammunition types available to a piece of artillery, the more adaptable it is to mission variation. Third, the degrees of elevation change for a piece of artillery is essential in this environment. A larger degree of elevation change results in a more capable artillery piece. Additionally, negative degrees of depression, to shoot down mountain ridge, also results in a more capable artillery piece. Forth, increased mobility reduces the time for artillery setup. This also enables faster repositioning during quick military advances. Fifth, the more crew members required to operate a piece of artillery, the more complex and vulnerable the piece of artillery is. Sixth, all systems have effective fire direction control (FDC) centers

²⁷¹ These scores are found in the lower left corner of Table 2, Table 4, and Table 6.

²⁷² The numbers for priority population are found in the middle of Table 2, Table 4, and Table 6. The priorities are outlined in the upper right corner of the same tables.

²⁷³ Overall mission ranking for each artillery piece is found in the upper left corner of Table 2, Table 4, and Table 6.

to lay the line, calculate the elevation and deflection, and coordinate fires.²⁷⁴ Finally, crew members may be interchangeable in the Thirds Anglo-Afghan War, meaning the loss of one crew member will not shut down the gun; however, this changes as the artillery becomes more modern, and crew members are not interchangeable in the other two cases. Finally, mechanization changed drastically of time. All artillery utilized in the Soviet and in the U.S. cases required mechanization, those requiring smaller vehicles are more adaptive. However, tracked units may be less affected by environmental conditions.

B. ARTILLERY SPECIFICATIONS FROM THIRD ANGLO-AFGHAN WAR

Table 1. Detailed Information for the Artillery the British Empire Utilized in the Third Afghan-Anglo War

Artillery	Mission Flexibility				Operational Environment					Required Spt & Capability		
	Shrapnel	High Explosive	Smoke & Gas	Incendiary & Star	Probable miss distance	Weight in lbs	Range in Yrds	Elevation	Rate Per Min	Crew	Tow	Ammo
RHA QF 13-Pndr	1	1	N/A	N/A	Greater than 60 Yrds	2,236	5,900	-5° to +16°	15	9	Horse	Fixed round
RHA QF 18-Pndr	1	1	1	1	60 Yrds	2,825	6,525	-5° to +37°	20	10	Horse	Fixed round
BL 60-Pndr	N/A	1	.5	.5	45 Yrds	10,000	15,500	-4° to +35°	2	10	Tractor	Separate round
3.7 Inch Howitzer	1	1	.5	1	Experimental	1,610	5,899	-5° to +40°	8	8	Pack	Separate round
4.5 Inch Howitzer	1	1	1	1	45 Yrds	3,010	7,300	-5° to +45°	6	6	horse	Separate round
6 Inch Howitzer	N/A	1	.5	.5	50 Yrds	2,856	11,400	0° to +45°	2	10	tractor	Separate round

Adapted from: Dale Clarke, *British Artillery 1914–19: Field Army Artillery*. Vol. 94. (Oxford, Osprey Publishing, 2004).

²⁷⁴ Each table contains weighted data for analysis using the FDC abbreviation for coordinated fires under commander priorities. Additionally, there are nine capabilities listed out in the middle of the table due to differing commander priorities for shaping, offensive, and defensive missions.

Table 2. Weighted Artillery Capabilities Based on Commander's Priorities That May Have Existed during the Third Anglo-Afghan War

Artillery type (Used)				Desired Capabilities based on mission								
	Shaping	Defensive	Offensive	Importance	Shaping	Defensive	Offensive					
RHA QF 13-Pounder Gun	2	3	3	1	High volume (#)	High Volume (#)	Precision					
RHA QF 18-Pounder Gun	1	2	1	2	coordinated fires	High lethality (burst)	Range					
BL 60-Pounder Gun	5	5	5	3	Range	Reliability	Flexibility					
3.7 Inch Howitzer	3	1	2	4	Mobility	Direct & indirect cap	Mobility					
4.5 Inch Howitzer	4	4	4	5	Reliability	self-defense	Reliability					
6 Inch Howitzer	6	6	6									
Artillery type (Used)				High Volume	High Lethality	Mobility	Range	Precision	FDC	Direct & indirect	Flexibility	reliability
RHA QF 13-Pounder Gun	2	6	2	5	5	3	6	6	2			
RHA QF 18-Pounder Gun	1	1	3	4	4	1	3	1	1			
BL 60-Pounder Gun	6	4	5	1	1	6	4	4	5			
3.7 Inch Howitzer	3	2	1	6	6	2	1	3	3			
4.5 Inch Howitzer	4	3	5	3	2	4	2	2	4			
6 Inch Howitzer	5	5	4	2	3	5	5	5	6			
Artillery type (Used)				Shaping	Defensive	Offensive	Raw Data:					
RHA QF 13-Pounder Gun	41	54	51	Artillery was ranked based on capability compared to all other available artillery pieces in theater. For mission ranking, capability was weighted by the importance assigned by the commander. This is derived from the irregular warfare doctrine. The artillery with the lowest number meets mission requirements the best. The data supports the QF 18-pounder gun as the most capable based on modern doctrine for this environment.								
RHA QF 18-Pounder Gun	32	33	32									
BL 60-Pounder Gun	66	70	60									
3.7 Inch Howitzer	44	25	46									
4.5 Inch Howitzer	61	55	54									
6 Inch Howitzer	67	73	68									

Based on the weighted data, the QF 18-Pounder Gun would be the best shaping artillery with a score of 32, the QF 3.7 Howitzer would be the best defensive artillery with a score of 25, and the QF 18-Pounder Gun would be the best offensive artillery piece with a score of 32. These scores are derived from commander priorities, the operating environment, and the weapon systems capability. Therefore, of the available artillery, these two artillery pieces represent a right-tech solution based on flexibility, environment, support and capability, and the proposed commander priorities for this conflict. They represent the most capable artillery available for these three missions, or a right-tech solution.

C. ARTILLERY SPECIFICATIONS: THE SOVIET UNION AFGHANISTAN INVASION

Table 3. Detailed Information for All the Artillery the Soviet Union Utilized in This War

Artillery	Mission Flexibility							Operational Environment					Required Spt & Capability			
	Frag	AP-T	Nuc	HE	RAP/ PGM	Smoke & Gas	Heat & Illum	Prob-miss distance	Weight in lbs	Range in meters	Elevation /Traverse	Rate Per Min	Crew	Towed/ Self-P	Speed/ Range	Ammo
RPU-14	1	N/A	N/A	1	N/A	1	.5 Illum	136 meters @Max	2,392	9,810	0° to +45°	16	5	4x4	N/A	Rocket: 4 min reload
BM-21	1	N/A	N/A	1	.5 Long	1	N/A	200 meters @10KM	30,225	S: 11,000 L: 20,380	0° to +50° 240°	40	6	Self-P 6x6	47 MPH 252 Miles	Rocket: 10 min reload
BM-27	1	N/A	N/A	1	N/A	.5 Gas	.5 Heat	200 meters @10KM	50,155	40,000	+15° to +55° 360°	16	6	Self-P 8x8	40 MPH 310 Miles	Rocket: 15 min reload
2S1	1	1	N/A	1	.5 RAP	1	1	21 meters @10KM	35,273	15,300 RAP: 21,900	-3° to +70° 360°	5	5	Self-P Track*	37 MPH 310 Miles	Case Semi-Auto
2S3	1	1	1	1	.5 RAP	N/A	1	100 meters @10KM	50,700	18,500 RAP: 24,000	-3° to +65° 360°	4	6	Self-P Track	34 MPH 186 Miles	Case Semi-Auto
2S4	1	.5 Light	1	1	1	.5 Gas	N/A	10 meters @10KM	60,000	9,650 RAP: 18,000	+50° to +80° 20°	1	9	Self-P Track	39 MPH 310 Miles	Proj/Bag Sep load
2S9	N/A	1	N/A	1	.5 RAP	.5 Smoke	.5 Heat	150 meters @10KM	19,180	8,850 RAP: 12,800	-4° to +80° 95°	10	4	Self-P Track*	37 MPH 310 Miles	Case Semi-Auto
2B9	1	.5 Light	N/A	1	N/A	.5 Smoke	1	64 meters @Max	1,422	4,270	-1° to +85° 360°	100	6	4x2	N/A	Case Clip Fed
M-46	1	1	N/A	1	.5 RAP	.5 Smoke	.5 Illum	29 meters @10KM	18,629	27,150 RAP: 34,360	-2.5° to +45° 50°	6	9	Track	N/A	Case Sep load
D-20	1	.5 Light	1	1	.5 RAP	1	1	25 meters @10KM	12,566	17,410 RAP: 24,000	-5° to +63° 58°	6	10	6x6 or track	N/A	Case Sep load
D-30	1	N/A	N/A	1	.5 RAP	1	1	21 meters @10KM	7,077	15,400 RAP: 21,900	-7° to +70° 360°	8	7	6x6 or track	N/A	Case Sep load

Adapted from: Foss, *Jane's Armour and Artillery 1984–85*. Hull, Markov, and Zaloga, *Soviet/Russian Armor and Artillery Design Practices: 1945 to Present*. Genys, *2S9 Nona- s 120-mm self-propelled mortar system*.

Table 4. Weighted Artillery Capabilities Based on Commander's Priorities That May Have Existed during the Soviet Invasion of Afghanistan

Artillery type (Used)	Shaping	Defensive	Offensive						
RPU-14 140mm Rockets	11	8	10						
BM-21 122mm Rocket	1	2	1						
BM-27 220mm Rocket	2	3	3						
2S1 122mm Howitzer	4	6	5						
2S3 152mm Howitzer	6	9	7						
2S4 Tyulp 240mm Mortar	9	10	8						
2S9 Nona 120mm Mortar	8	4	11						
2B9 Vasilek 82mm Gun	3	1	4						
M-46 130mm Gun	10	11	9						
D-20 152mm howitzer	5	7	2						
D-30 122mm Howitzer	7	5	6						
Artillery type (Used)	High Volume	High Lethality	Mobility	Range	Precision	FDC	Direct & indirect	Flexibility	reliability
RPU-14 140mm Rockets	4	3	8	10	8	11	9	10	6
BM-21 122mm Rocket	2	2	1	7	10	6	7	8	2
BM-27 220mm Rocket	3	4	2	1	11	5	10	11	5
2S1 122mm Howitzer	9	8	5	6	2	1	4	3	8
2S3 152mm Howitzer	10	10	6	3	7	2	5	2	9
2S4 Tyulp 240mm Mortar	11	11	3	8	1	4	11	4	11
2S9 Nona 120mm Mortar	5	7	4	9	9	3	2	9	10
2B9 Vasilek 82mm Gun	1	1	7	11	6	7	1	7	1
M-46 130mm Gun	8	9	11	2	5	10	8	5	7
D-20 152mm howitzer	7	6	10	4	4	8	6	1	3
D-30 122mm Howitzer	6	5	9	5	3	9	3	6	4
Artillery type (Used)	Shaping	Defensive	Offensive						
RPU-14 140mm Rockets	118	104	120						
BM-21 122mm Rocket	49	45	62						
BM-27 220mm Rocket	49	76	79						
2S1 122mm Howitzer	89	90	83						
2S3 152mm Howitzer	92	107	88						
2S4 Tyulp 240mm Mortar	110	125	96						
2S9 Nona 120mm Mortar	104	77	120						
2B9 Vasilek 82mm Gun	81	45	82						
M-46 130mm Gun	113	134	103						
D-20 152mm howitzer	90	102	70						
D-30 122mm Howitzer	95	85	87						
				Raw Data:					
				Artillery was ranked based on capability compared to all other available artillery pieces in theater. For mission ranking, capability was multiplied by the importance assigned by the commander. This is derived from the irregular warfare doctrine. The artillery with the lowest number meets mission requirements the best. The data supports the BM-21 Grand as the most capable for this environment. If the commander wanted the best artillery piece for each mission as outlined, the data supports the BM-21 Grand for two of the missions, and the 2B9 Vasilek for the remaining mission set.					

Based on the weighted data, the BM-21 MRLS would be the best shaping and offensive artillery piece with scores of 49 and 62 respectively, and the 2B9 Vasilek would be the best defensive artillery piece with a score of 45.²⁷⁵ These scores are derived from commander priorities, the operating environment, and the weapon systems capability. Therefore, of the available artillery, these two artillery pieces represent a right-tech solution based on flexibility, environment, support and capability, and the proposed commander priorities for this conflict.

²⁷⁵ The shaping score for the BM-21 and BM-27 are the same, I chose the BM-21 due to its higher missile load out and reliability compared to the BM-27.

D. ARTILLERY SPECIFICATIONS: UNITED STATES AFGHANISTAN CONFLICT

Table 5. Detailed Information for All the Artillery the United States Utilized in Afghanistan during the War on Terror

Artillery	Mission Flexibility						Operational Environment					Required Spt & Capability			
	Frag	AP-T	HE	RAP/ PGM	Smoke & Gas	Heat & Illum	Prob-miss Distance @ Max Range	Weight in lbs	Range in meters	Elevation /Traverse	Rate Per Min	Crew	Towed/ Self-P	Speed/ Range	Ammo
M120 Mortar	1	N/A	1	.5	.5	.5	136 Meters PGM: 10 meters	330	7,200	39° to +85° 360°	16	5	4x4 or carried	N/A	N/A
M777 Howitzer	1	1	1	1	1	1	270 Meters PGM: 10 meters	9,260	24,700 RAP: 30,000	0° to +72°	5	8	4x4 or Sling	N/A	Case Semi-Fixed
M119 Howitzer	1	1	1	1	1	1	163 Meters PGM:10 meters	4,520	14,000 RAP: 19,000	-5.5° to +70° 360°	6	7	4x4 or Sling	N/A	Case Semi-Fixed
M142 HIMARS	1	N/A	1	N/A	N/A	N/A	100 Meters PGM: 10 Meters	24,000	32,000 MLR 300,000 ATA	N/A 360°	12	3	5 Ton Truck	53MPH 300 Miles	6x227mm Rockets

Adapted from: Christopher Foss, *Jane's Armour and Artillery*, Vol. 23. Federation of American Scientists; FAS Military Analysis Network U.S. Land Warfare Systems.

Table 6. Weighted Artillery Capabilities Based on Commander's Priorities That May Have Existed During the United States Afghan Conflict

Artillery type (Used)	Shaping	Defensive	Offensive							Desired Capabilities based on mission			
M120 Mortar	2	2	1							Importance	Shaping	Defensive	Offensive
M777 155 Howitzer	4	4	4							1	High volume (#)	High Volume (#)	Precision*
M119 105 Howitzer	1	1	2							2	coordinated fires	High lethality (burst)	Range
M142 HIMARS	3	3	3							3	Range	Reliability	Flexibility
										4	Mobility	Direct & indirect cap	Mobility
										5	Reliability	self-defense	Reliability
Artillery type (Used)	High Volume	High Lethality	Mobility	Range	Precision	FDC	Direct & indirect	Flexibility	reliability				
M120 Mortar	1	4	1	4	4	3	3	1	2				
M777 155 Howitzer	4	2	5	2	2	2	2	3	3				
M119 105 Howitzer	3	3	3	3	3	1	1	2	1				
M142 HIMARS	2	1	2	1	1	4	4	4	4				
Artillery type (Used)	Shaping	Defensive	Offensive							Raw Data:			
M120 Mortar	33	32	29							Artillery was ranked based on capability compared to all other available artillery pieces in theater. For mission ranking, capability was multiplied by the importance assigned by the commander. The artillery with the lowest number meets mission requirements the best.			
M777 155 Howitzer	49	50	50										
M119 105 Howitzer	31	31	32										
M142 HIMARS	41	42	43										

Based on the weighted data, the M119 Howitzer would be the best shaping and defensive artillery piece with scores of 31 respectively, and M120 mortar would be the best

offensive artillery piece. These scores are derived from commander priorities, the operating environment, and the weapon systems capability. Therefore, of the available artillery, these two artillery pieces represent a right-tech solution based on flexibility, environment, support and capability, and the proposed commander priorities for this conflict. They represent the most capable artillery available for these three missions.

APPENDIX B. AIRCRAFT

A. THE MISSION IN IRREGULAR WARFARE

For a complete understanding of the military mission in irregular warfare refer to Appendix for the complete doctrine review.²⁷⁶ The doctrine review in this Appendix is limited to airpower. The AFSOF annex includes the core mission sets that further define air operations in irregular warfare.²⁷⁷ The AFSOF annex explains each of these core functions and highlights the AFSOF contribution to these activities. This ensures each Air Force major command remains focused on their role for irregular warfare, and the core mission set that goes with it. In other words, the AFSOF annex addresses more than just SOF air assets; it defines the role for conventional forces as well. For example, mobility command is responsible for large scale movements and the logistics that goes with it, while AFSOC remains focused on special unit intel, strike, and light mobility. This enables each of those commands to focus on technology relevant to its core mission set, but does not suggest the level of technology that should be used.²⁷⁸ *JP 1*, *JP 3-0*, and *JP 3-05* all suggest that every U.S. military unit needs to be trained and equipped for the missions listed under irregular warfare. Therefore, the mission priorities and assumptions listed below are applicable to all U.S. military units, and may be tailored based on commanders needs to fill the gap left in the doctrine.

Now it is up to the overall campaign commander and air component commander to outline the requirements for aircraft assets based on the mission and environment. After consulting this doctrine and several experts in this field at the command level, one way to outline these requirements is through stacking priorities. As an example, a commander may develop priorities based on missions such as look, lift, and strike capabilities. Once missions are decided on, the commander and staff will stack priorities

²⁷⁶ United States Joint Chiefs of Staff, *Joint Publication 3-05, Special Operations*. Washington, DC: United States Joint Chiefs of Staff. July 16, 2014. United States Air Force, *Air Force Doctrine Document 3-2, Irregular Warfare*. Washington DC: Department of the Air Force, 2013), 5.

²⁷⁷ United States Joint Chiefs of Staff, *Special Operations, Joint Publication 3-30, Command and Control of Air Operations*. Washington, DC: United States Joint Chiefs of Staff. February 10, 2014.

²⁷⁸ Ibid.

based on capability. For the strike category an example of stacked priorities might include accuracy, followed by air and ground capable, day and night operations, long loiter time, and finally low required support. Once this has been completed the raw data is mathematically weighted by the commanders stacked priorities.

Once all the priorities have been established, and all available aircraft have been outlined, the raw data can be populated based on ranking.²⁷⁹ For example, the raw data suggests the Handley Page 1500 has the longest flight duration, and the Bristol Fighter has the shortest flight duration; therefore, the Handley Page 1500 is ranked number 1 of 6, and the Bristol Fighter is number 6 of 6.²⁸⁰ All remaining aircraft are ranked somewhere in between. Additionally, the stacked commander priorities are given a number value as well to enable the waiting process. The highest priority is given a value of 1, and the lowest priority receives a value of 5 since that is all the listed priorities for this example. Once this is complete, simply multiply the aircraft ranking number by the number value assigned to the commanders priorities and add them up. The formula for weighting each capability is as follows: (required capability*commander priority ranking). Once each capability is multiplied by the commander's priority ranking, all five scores are added up for their total score for final ranking.

For example, the Bristol Fighter, in the Third Anglo-Afghan War case study, has three different scores based on mission: 54 for look operations, 53 for lift operations, and 62 for strike operations.²⁸¹ Using the formula outlined above, the Bristol Fighter look formula is: (intelligence*priority 1) + (loiter time*priority 2) + (communication*priority 3) + (24 hour capable*priority 4) + (required support*priority 5) = score.²⁸² In number form this is $(4*1) + (6*2) + (3*3) + (6*4) + (1*5) = 54$.²⁸³ Once each aircraft has been weighted based on commander's priorities, each aircraft is then ranked where the best

²⁷⁹ See the upper right corner of Table 8, Table 10, and Table 12 for commander priorities for each case study. For this paper, each table shares the same commander priorities. Additionally, there is a table at the beginning of each case study with the basic capabilities of each aircraft, or the raw data.

²⁸⁰ See Table 7 for details.

²⁸¹ These scores are found in the lower left corner of Table 8, Table 10, and Table 12.

²⁸² The numbers for priority population are found in the middle of Table 8, Table 10, and Table 12. The priorities are outlined in the upper right corner of the same tables.

²⁸³ See Table 8 for details.

aircraft gets the lowest score and the worst gets the highest score. The Bristol Fighter in this example ranked third for look operations based on available aircraft.

Each case study has a table that highlights specific capabilities for each aircraft that was available for use. This data has been divided into three main categories for overall ranking to include mission flexibility, operational environment, and required support. Many of the sub-categories can be directly transferred to the commander's priority tables like flight duration example above; however, some of the commander priorities must use multiple sub-categories to form an aircraft ranking.²⁸⁴ An example of this is the requirement to provide good intelligence. The commander priority list has this as a requirement, but this is not a listed capability like flight duration and altitude capabilities. Therefore, multiple sub-categories must be combined to form an intelligence capable score. In this example mission capability, weather requirements, and the number of aircrew formed the intelligence capability composite score. Finally, each case study required multiple assumptions. Many of these assumptions are present in each case study, but some are case dependent. Thus, I have listed all assumptions for each case study within its section understanding it is a little redundant. However, it enables the reader to see all assumptions made while looking at the tables of data for each case study.

Finally, several assumptions have been stipulated for the culmination of this data. First, the aircraft environment focuses on conditions important to Afghanistan, and the eastern frontier. Altitude becomes very important due to high terrain in the area. Second, no consideration was given to aircraft operating from outside Afghanistan in this conflict. The Soviets and the U.S. use many aircraft in their campaign from external locations; however, the environmental conditional are different for their maintenance, logistics, and airfield operations. Additionally, some aircraft that operated internal to Afghanistan were excluded in this analysis due to classification of available data, and may have impacted the overall calculations. Third, support or logistics are considered a limiting factor in this remote land locked environment; however, the Soviets were did share a border with Afghanistan, and may have been less limited. Forth, some aircraft are listed as all-

²⁸⁴ See Appendix A, The Mission in Irregular Warfare, for category and sub-category definitions. The sub-categories are different in Appendix A, but their role is the same.

weather capable; others are listed as bad-weather capable. Those aircraft listed as bad-weather capable were considered less capable than those listed as all-weather. Fifth, the nation-state Air Force has air superiority; otherwise, there is another near peer actor introducing technology in irregular warfare, and the technology introduced needs to be adjusted for. Finally, higher crew member count helps mission effectiveness through delegation of duties; thus, better communications, accuracy during targeting, recording intelligence, and night sortie effectiveness. However, there is a higher support cost for maintaining more personnel.

B. AIRCRAFT SPECIFICATIONS FROM THIRD ANGLO-AFGHAN WAR

Table 7. Detailed Information for All the Aircraft the British Empire Utilized in the Third Anglo-Afghan War

Aircraft	Mission flexibility				Operational environment				Required Spt & capability			
	Recon	Bomber	fighter	Cargo	Max Alt in ft	Max Speed in mph	Day	Night	guns	crew	Fuel	Cargo
Royal Aircraft B.E.2c	1	.5	.5	N/A	10,000	72	1	1	1	2	3.1hr	244lbs in bombs 980lbs
Handley O400	.5	1	N/A	1	8,500	97.5	1	1	5	3	8.5hr 300gl	2,000lbs in bombs 18 pax 2700lbs
Handley 1500	.5	1	N/A	1	11,000	99	1	1	3	3	14hr 1000gl	7,500lbs in bombs 45 pax 10,000lb
Bristol F2 Fighter	1	N/A	1	N/A	18,000	123	1	N/A	1	2	3hr 45gl	240lbs in bombs 1,100lbs
Airco DH9a	.5	1	N/A	.5	16,750	123	1	N/A	3	2	5.25hr 112gl	740lbs in bombs 2,160lbs
Airco DH10	N/A	1	N/A	.5	19,000	131	1	N/A	4		6hr 215gl	920lbs in bombs 3,145lbs

Adapted from: Christopher Foss, *Jane's all the World's Aircraft 1919*, 35a-120a; Mason, *The British Bomber since 1914*, 94-115; Bruce, *British Aeroplanes, 1914-18*, 360-380.

Table 8. Weighted Aircraft Capabilities Based on Commander's Priorities That May Have Existed during the Third Anglo-Afghan War

Aircraft type (Used)	look	lift	strike							
Bristol F.2B Fighter	3	4	6							
Royal Acft B.E.2C	1	5	5							
Handley Page Acft 400	6	6	1							
Handley Page Acft 1500	5	3	3							
Airco DH10	4	2	4							
Airco DH9a	2	1	2							
				Desired Capabilities based on mission						
				Importance	Look	Lift	Strike			
				1	good intel	Carry heavy	Very accurate			
				2	Long Loiter	High Alt	long loiter			
				3	good comm.	pax and/or cargo	Air and/or ground			
				4	Day and night ops	Day and night ops	Day and night ops			
				5	Low required spt	Low required spt	Low required spt			
Aircraft type (Used)	Loiter time	lift capacity	bomb capacity	gun capacity	Altitude	Intell	good comm.	24 hour ops capable	Accuracy	Support
Bristol F.2B Fighter	6	5	5	5	2	4	3	6	6	1
Royal Acft B.E.2C	5	6	6	6	5	1	2	1	5	4
Handley Page Acft 400	2	3	2	1	6	2	6	3	1	5
Handley Page Acft 1500	1	1	1	4	4	3	5	2	3	6
Airco DH10	3	2	3	2	1	6	4	5	2	3
Airco DH9a	4	4	4	3	3	5	1	4	4	2
Aircraft type (Used)	Look Raw Data	Lift Raw Data	Strike Raw Data							
Bristol F.2B Fighter	54	53	62							
Royal Acft B.E.2C	41	58	57							
Handley Page Acft 400	61	58	46.5							
Handley Page Acft 1500	60	50	50.5							
Airco DH10	59	48	50.5							
Airco DH9a	42	48	48.5							
				Raw data						
				Each aircraft was ranked based on capability compared to all other available aircraft in theater. For mission ranking, capability was multiplied by the importance assigned by the commander. This is derived from the irregular warfare doctrine. The aircraft with the lowest number meets mission requirements the best. The data would support the DH9a as the most capable aircraft based on modern doctrine.						

Based on the weighted data, the Royal Aircraft B.E.2c would be the best look aircraft with a score of 41, the Airco D.H.9a would be the best lift aircraft with a score of 48, and the Handley Page 400 would be the best strike aircraft with a score of 46.5. These scores are derived from commander priorities, the operating environment, and the weapon systems capability. Therefore, of the available aircraft, these represent a right-tech solution based on flexibility, environment, support and capability, and the proposed commander priorities for this conflict. They represent the most capable aircraft available for these three missions internal to theater operations.

C. AIRCRAFT SPECIFICATIONS: THE SOVIET UNION AFGHANISTAN INVASION

Table 9. Detailed Information for All the Aircraft the Soviet Union Utilized within This Afghanistan Conflict

Aircraft	Mission flexibility						Operational environment						Required Spt & capability			
	Recon	Bomber	fighter	Cas-evac	CAS	Cargo	Max Alt in ft	Max Speed	STOL	ECM	Day/Night	All WX	Guns/Pylons	crew	Combat Radius	Cargo
SU-17	N/A	.5	1	N/A	1	N/A	59,050	Mach 2.17	N/A	.7	1	1	2/8	1	620 nm .80hr	wpns load 8,820 lbs
SU-24	N/A	1	.5	N/A	1	N/A	57,400	Mach 2	N/A	.5	1	1	1/8	2	970 nm 1.21hr	wpns load 17,635 lbs
SU-25	.5	1	.7	N/A	1	N/A	22,965	606 mph	N/A	.5	1	.5	1/10	1	675 nm 1.11hr	wpns load 14,100 lbs
MiG-23	N/A	.5	1	N/A	N/A	N/A	61,000	Mach 2.35	N/A	1	1	1	1/6	1	650 nm .75 hr	wpns load 4,410 lbs
Mi-4	1	N/A	N/A	1	.5	1	18,000	130 mph	1	N/A	1	.5	1	3	217 nm 1.67hr	3,835 lbs 16 PAX
Mi-8	1	.5	N/A	1	1	1	14,760	155 mph	1	N/A	1	1	1/6	3	507 nm 3.27hr	8,820 lbs 32 PAX
Mi-24	1	1	1	1	1	1	14,750	199 mph	1	N/A	1	1	1/8	3	431 nm 2.15hr	5,290 lbs 8 PAX
An-12	1	.5	N/A	N/A	N/A	1	33,500	482 mph	1	.5	1	1	2	6	3,075 nm 6.5 hr	44,090 lbs 90 PAX
An-22	N/A	N/A	N/A	N/A	N/A	1	32,780	460 mph	1	N/A	1	.5	N/A	6	5,905 nm 12.5hr	176,350 lbs 724 PAX
Il-76	N/A	N/A	N/A	1	N/A	1	38,960	528 mph	N/A	N/A	1	1	N/A	7	3,617 nm 7hr	88,185 lbs 30 PAX

Adapted from: Janes, *Jane's all the World's Aircraft* (1985). Nelson, *Soviet Air Power: Tactics and Weapons Used in Afghanistan*, 30; Ilyushin Il-76 *Candid Long-range transport aircraft*, Military-today, (accessed July 7, 2015), http://www.military-today.com/aircraft/ilyushin_il76_candid.htm Antonov An-22 *Antei Heavy transport aircraft*, Military-today, (accessed July 7, 2015), http://www.military-today.com/aircraft/an_22.htm Antonov An-12 *Tactical transport aircraft*, Military-today, (accessed July 7, 2015), http://www.military-today.com/aircraft/an_12.htm.

Table 10. Weighted Aircraft Capabilities Based on Commander's Priorities That May Have Existed during This Soviet Afghanistan Conflict

Aircraft type(Used)	look	lift	strike									
SU-17 Fitter	5	3	4									
SU-24 Fencer	7	6	7									
SU-25 Frogfoot	4	5	3									
MiG-23 Flogger	8	7	8									
Mi-4 Hound	10	10	9									
Mi-8 Hip	6	8	6									
Mi-24 Hind	2	4	1									
An-12 Cub	1	1	2									
An-22 Cock	3	2	5									
IL-76 Candid	9	9	10									
Aircraft type(Used)	look	lift	strike									
				Desired Capabilities based on mission								
				Importance	Look	Lift	Strike					
				1	good intel	Carry heavy	Very accurate					
				2	Long Loiter	High Alt	Air and/or ground					
				3	good comm.	pax and/or cargo	Day and night ops					
				4	Day and night ops	Day and night ops	Long Loiter					
				5	Low required spt	Low required spt	Low required spt					
Aircraft type(Used)	Loiter time	lift capacity	wpns capacity	gun capacity	Pax/Cargo	Altitude	Intell	comm	24 hour ops capable	Accuracy	Support	
SU-17 Fitter	9	7	3	3	9	2	8	10	5	3	2	
SU-24 Fencer	7	4	4	6	7	3	9	8	6	5	7	
SU-25 Frogfoot	8	5	1	2	8	7	5	5	2	1	5	
MiG-23 Flogger	10	9	6	7	10	1	7	9	4	6	8	
Mi-4 Hound	6	10	8	5	5	8	4	7	9	7	9	
Mi-8 Hip	4	6	5	4	4	9	3	6	8	4	6	
Mi-24 Hind	5	8	2	1	6	10	1	2	3	2	3	
An-12 Cub	3	3	7	8	2	5	2	1	1	8	1	
An-22 Cock	1	1	9	9	1	6	6	3	7	9	4	
IL-76 Candid	2	2	10	10	3	4	10	4	10	10	10	
Aircraft type(Used)	Look Raw Data	Lift Raw Data	Strike Raw Data									
SU-17 Fitter	86	68	76									
SU-24 Fencer	106	90	106									
SU-25 Frogfoot	69	76	70									
MiG-23 Flogger	110	97	124									
Mi-4 Hound	118	122	129									
Mi-8 Hip	91	98	92									
Mi-24 Hind	44	73	52									
An-12 Cub	20	28	58									
An-22 Cock	65	64	90									
IL-76 Candid	116	109	138									
				Raw data								
				Each aircraft was ranked based on capability compared to all other available aircraft in theater. For mission ranking, capability was multiplied by the importance assigned by the commander. This is derived from the irregular warfare doctrine. The aircraft with the lowest number meets mission requirements the best. The data would support the Hind and Cub as the most capable aircraft.								

Based on the weighted data, the Antonov An-12 would be the best look and lift aircraft with a score of 20 and 28, the Mikhail Leont'yevich Mil Mi-24 would be the best strike aircraft with a score of 52. Additionally, one could argue the Mi-24 may be a better look platform based on sensor system availability. These scores are derived from commander priorities, the operating environment, and the weapon systems capability. Therefore, of the available aircraft, these represent a right-tech solution based on flexibility, environment, support and capability, and the proposed commander priorities for this conflict. They represent the most capable aircraft available for these three missions internal to theater operations.

D. AIRCRAFT SPECIFICATIONS: UNITED STATES IN AFGHANISTAN CONFLICT

Table 11. Detailed Information for Most of the Aircraft the United States Utilized within the Afghanistan Conflict

Aircraft	Mission flexibility						Operational environment						Required Spt & capability			
	Recon	Bomber	fighter	Cas-evac	CAS	Cargo	Max Alt in ft	Max Speed	STOL	ECM	Day/Night	All WX	Guns/Pylons	crew	Combat Radius	Cargo
AC-130	1	.5	N/A	N/A	1	N/A	30,000	300 mph	N/A	1	1	1	3/2	13	2,200 nm 8.5 hr	wpns load 30,000 lbs
A-10	1	1	.5	N/A	1	N/A	45,000	518 mph	N/A	.5	1	1	1/11	1	250 nm 1.88 hr	wpns load 16,000 lbs
F-16	.5	1	1	N/A	1	N/A	50,000	Mach 2	N/A	.5	1	.5	1/11	1	735 nm 1.45 hr	wpns load 17,000 lbs
F-15E	.5	1	1	N/A	1	N/A	60,000	Mach 2.5	N/A	1	1	1	1/14	2	685 nm 1.35 hr	wpns load 24,500 lbs
Ch-47	1	N/A	N/A	1	.5	1	18,500	196 mph	1	1?	1	1	1	3	400 nm 3.1 hr	28,000 lbs 55 PAX
OH-58	1	.5	N/A	1	1	N/A	15,000	149 mph	1	N/A	1	.5	1/2	2	161 nm 2.0 hr	2,000 lbs 6 PAX
AH-1	1	.5	.5	N/A	1	N/A	20,000	255 mph	1	.5	1	.5	1/6	2	370 nm 3.3 hr	wpns load 5,764 lbs
AH-64	1	.5	.5	N/A	1	N/A	19,400	182 mph	1	.5	1	.5	1/4	2	257 nm 2.5 hr	wpns load 6263 lbs
UH-60	1	N/A	N/A	1	1	1	19,000	222 mph	1	.5	1	.5	2	4	320 nm 2.5 hr	9,000 lbs 11 PAX
V-22	1	N/A	N/A	1	.5	1	24,700	316 mph	1	1	1	1	1/0	4	950 nm 3.5 hr	20,000 lbs 24 PAX
C-130	N/A	.5	N/A	1	N/A	1	33,000	366 mph	.5	1	1	1	N/A	5	2,040 nm 8.5 hr	45,000 lbs 92 PAX
C-17	N/A	N/A	N/A	1	N/A	1	45,000	517 mph	.5	1	1	1	N/A	3	5,610 nm 9.6 hr	170,900 lbs 134 PAX
C-5	N/A	N/A	N/A	1	N/A	1	35,700	579 mph	N/A	1	1	1	N/A	7	4,800 nm 11 hr	285,000 lbs 322 PAX

Adapted from: Paul Jackson, *Jane's all the World's Aircraft 2002–2003* (Alexandria, VA: Jane's Information Group Limited, 2002); Federation of American Scientists; FAS Military Analysis Airpower Overview, (accessed Aug 21, 2015), <http://fas.org/man/dod-101/sys/ac/index.html>; U.S. Air Force, Air Force Aircraft Fact Sheets, (accessed Aug 30, 2015), <http://www.af.mil/AboutUs/FactSheets.aspx>.

**Table 12. Weighted Aircraft Capabilities Based on Commander's Priorities
That May Have Existed during the United States–Afghanistan
Conflict**

Aircraft type (Used)	look	lift	strike	Desired Capabilities based on mission											
AC-130 Gunship	1	6	1									Importance	Look	Lift	Strike
A-10 Thunderbolt	3	3	2									1	good intel	Carry heavy	Very accurate
F-16 Falcon	12	12	12									2	Long Loiter	High Alt	Air and/or ground
F-15E Strike Eagle	13	13	13									3	good comm.	pax and/or cargo	Day and night ops
CH-47 Chinook	4	5	7									4	Day and night ops	Day and night ops	Long Loiter
OH-58 Kiowa	10	10	9									5	Low required spt	Low required spt	Low required spt
AH-1 Super Cobra	8	9	3												
AH-64 Apache	9	8	4												
UH-60 Black Hawk	6	7	5												
V-22 Osprey	11	11	11												
C-130 Hercules	2	1	6												
C-17 Globemaster	5	2	8												
C-5 Galaxy	7	4	10												
Aircraft type (Used)	loiter time	lift capacity	wpns capacity	gun capacity	Pax/Cargo	Altitude	Intell	comm	24 hour ops capable	Accuracy	Support				
AC-130 Gunship	3	4	1	1	8	7	1	1	5	6	7				
A-10 Thunderbolt	11	9	4	4	13	3	9	12	3	2	1				
F-16 Falcon	12	8	3	10	12	2	10	13	11	3	10				
F-15E Strike Eagle	13	6	2	9	11	1	8	11	12	1	11				
CH-47 Chinook	7	5	9	7	4	12	4	4	6	10	6				
OH-58 Kiowa	10	13	7	5	7	13	5	8	13	7	2				
AH-1 Super Cobra	6	12	5	2	10	9	7	9	8	4	5				
AH-64 Apache	9	11	6	3	9	10	6	10	9	5	4				
UH-60 Black Hawk	8	10	8	6	6	11	2	6	10	8	3				
V-22 Osprey	5	7	10	8	5	8	3	5	7	9	13				
C-130 Hercules	4	3	11	11	3	6	11	3	1	11	8				
C-17 Globemaster	2	2	12	12	2	4	12	7	2	12	9				
C-5 Galaxy	1	1	13	13	1	5	13	2	4	13	12				
Aircraft type (Used)	look raw data	lift raw data	Strike Raw Data	Raw data Each aircraft was ranked based on capabiity compared to all other available aircraft in theater. For mission ranking, capability was multiplied by the importance assigned by the commander. This is derived from the irregular warfare doctrine. The aircraft with the lowest number meets mission requirments the best.											
AC-130 Gunship	65	97	72												
A-10 Thunderbolt	84	71	76												
F-16 Falcon	167	142	160												
F-15E Strike Eagle	170	144	166												
CH-47 Chinook	84	95	118												
OH-58 Kiowa	111	122	120												
AH-1 Super Cobra	103	117	91												
AH-64 Apache	110	114	106												
UH-60 Black Hawk	91	105	113												
V-22 Osprey	121	131	151												
C-130 Hercules	72	68	114												
C-17 Globemaster	90	69	119												
C-5 Galaxv	97	90	141												

Based on the weighted data, the AC-130 would be the best look and strike aircraft, and the Lockheed C-130 would be the best lift aircraft. Additionally, during phase four the AC-130 was not available in significant number, suggesting the Fairchild Republic A-10 was the best strike asset. Additionally, if a long loiter aircraft was not available, with correct sensor equipment, the A-10 was also the next best look asset. Finally, while the data shows the C-130 as the best lift aircraft, the C-17 was within one point of total weighted analysis suggesting they may be interchangeable. More

importantly, of the available aircraft, these represent a right-tech solution based on flexibility, environment, support and capability, and the proposed commander priorities for this conflict. They represent the most capable aircraft available for these three missions internal to theater operations.

LIST OF REFERENCES

- Adamec, Ludwig W. *Afghanistan, 1900–1923: A Diplomatic History*. Berkeley, CA: University of California Press, 1967.
- Arquilla, John. *Insurgents, Raiders, and Bandits: How Masters of Irregular Warfare have Shaped Our World*. Lanham, MD: Ivan R. Dee, 2011.
- Arreguín-Toft, Ivan. “How the Weak Win Wars: A Theory of Asymmetric Conflict.” *International Security* 26, no. 1 (2001).
- Baker, Chris. “The Royal Horse Artillery of 1914–1918: The Long, Long Trail.” Accessed May 26, 2015. <http://www.1914-1918.net/rha.htm>.
- Barthorp, Michael. *Afghan Wars and the North-West Frontier 1839–1947*. London: Cassel, 2002.
- Barzilai, Yaniv. *102 Days of War: How Osama Bin Laden, Al Qaeda, and the Taliban Survived 2001*. Washington, DC: Potomac Books, 2014.
- Baumann, Robert F. *Russian-Soviet Unconventional Wars in the Caucasus, Central Asia and Afghanistan*. Ft. Leavenworth, KS: Combat Studies Institute, 1993.
- Belasco, Amy. *Cost of Iraq, Afghanistan, and Other Global War on Terror Operations since 9/11* (CRS Report No. RL33110). Washington, DC: Congressional Research Service, 2013. <https://www.fas.org/sgp/crs/natsec/RL33110.pdf>.
- . *Troop Levels in the Afghan and Iraq Wars, FY2001-FY2012: Cost and Other Potential Issues* (CRS Report No. R40682) Washington, DC: Congressional Research Service, 2001. <https://www.fas.org/sgp/crs/natsec/R40682.pdf>.
- Benjamin, Medea. *Drone Warfare: Killing by Remote Control*. Brooklyn, NY: Verso Books, 2013.
- Bernstein, Jonathan, *AH-64 Apache Units of Operation Enduring Freedom and Iraqi Freedom*. Long Island, NY: Osprey Publishing, 2005.
- Biddle, Stephen. *Military Power: Explaining Victory and Defeat in Modern Battle*. Princeton, NJ: Princeton University Press, 2010.
- Binnendijk, Hans, ed. *Transforming America’s Military*. Washington, DC Center for Technology and National Security Policy: National Defense University, 2002.
- Bodansky, Yossef. “The Bear on the Chessboard: Soviet Military Gains in Afghanistan.” *World Affairs* (1982).

- Boot, Max. *War Made New: Technology, Warfare, and the Course of History, 1500 to Today*. New York, NY: Gotham Books, 2006.
- Bowyer, Chaz. *Handley Page Bombers of the First World War*. Warwick, RI: Aston, 1992.
- Bradsher, Henry St. Amant. *Afghanistan and the Soviet Union*. Durham, NC: Duke University Press, 1985.
- Bruce, John McIntosh. *British Aeroplanes, 1914–18*. New York: Putnam, 1957.
- Bush, George W. *The National Security Strategy of the United States of America*. Washington, DC: Executive Office of the President, 2002.
- Calloway, Audra. “PGK Arrives in Afghanistan Ahead of Fighting Season.” *Picatinny Voice* 26, no. 8 (April 19, 2013).
- Carlsson, Bo. “The Evolution of Manufacturing Technology and Its Impact on Industrial Structure: An International Study.” *Small Business Economics* 1, no. 1 (1989).
- Carus, Seth W. “Military Technology and the Arms Trade: Changes and Their Impact.” *Annals of the American Academy of Political and Social Science* (1994),
- Carter, Keith L. “Technology Strategy Integration.” Master’s thesis, Naval Postgraduate School, 2012.
- CBS News, “U.S. Formally Ends the War in Afghanistan,” December 28, 2014, <http://www.cbsnews.com/news/america-formally-ends-the-war-in-afghanistan/>. Accessed Aug 23, 2015.
- Clarke, Dale. *British Artillery 1914–19: Field Army Artillery*. Vol. 94. Oxford, Osprey Publishing, 2004.
- Coletta, Paolo E. “Launching the Doolittle Raid on Japan, April 18, 1942.” *Pacific Historical Review* (1993).
- Coleman, David. *U.S. Military Personnel 1954–2014*. <http://historyinpieces.com/research/us-military-personnel-1954-2014>. Accessed Aug 4, 2015.
- Daft, Richard. *Organization Theory and Design*. Mason OH: Cengage learning, 2012.
- Evans, Nigel F. “British Artillery, World War II,” <http://nigelef.tripod.com/gunsintro.htm>. Accessed May 21, 2015.
- Federation of American Scientists, “America’s War on Terrorism: Strategy and Weaponry.” <http://fas.org/terrorism/str/index.html>. Accessed Aug 13, 2015.

- . “FAS Military Analysis Airlift Cargo Aircraft,” http://fas.org/man/dod-101/sys/ac/lift_comp.htm. Accessed Aug 21, 2015.
- . “FAS Military Analysis Airpower Overview,” [US Military Aircraft](#). Accessed Aug 21, 2015.
- . “FAS Military Analysis Network U.S. Land Warfare Systems.” <http://fas.org/man/dod-101/sys/land/>. Accessed Aug 13, 2015.
- Fletcher, Arnold. *Afghanistan: Highway of Conquest*. Ithaca, NY: Cornell, 1965.
- Foss, Christopher F. Ed. *Jane’s Armour and Artillery*. Vol. 23. London: Jane’s Publishing Company Limited, 2002.
- . *Jane’s Armour and Artillery 1984–85*. New York, NY: Jane’s, 1985.
- Frank, Willard C., and Philip S. Gillette. *Soviet Military Doctrine from Lenin to Gorbachev 1915–1991*. Westport, CT: Greenwood Publishing, 1992.
- Gansler, Jacques S., and Brian Hughes. *Defense Science Board Task Force, Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics, “Fulfillment of Urgent Operational Needs,” July, 2009*.
- Gates, Robert M. “Balanced Strategy: Reprogramming the Pentagon for a New Age.” *Foreign Affairs*. 88, 2009. <https://www.foreignaffairs.com/articles/united-states/2009-01-01/balanced-strategy>. Accessed June 1, 2015.
- Genys, Andrius. *2S9 Nona-s 120-mm Self-Propelled Mortar System*, Military-today http://www.military-today.com/artillery/2s9_nona_s.htm. Accessed July 1, 2015.
- . *Antonov An-12 Tactical Transport Aircraft*, Military-today, http://www.military-today.com/aircraft/an_12.htm. Accessed July 7, 2015.
- . *Antonov An-22 Antei Heavy Transport Aircraft*, Military-today, http://www.military-today.com/aircraft/an_22.htm. Accessed July 7, 2015.
- . *Ilyushin Il-76 Candid Long-range Transport Aircraft*, Military-today, http://www.military-today.com/aircraft/ilyushin_il76_candid.htm. Accessed July 7, 2015.
- . *Mikoyan MiG-23 Flogger Tactical Fighter*, Military-today, http://www.military-today.com/aircraft/mikoyan_mig_23_flogger.htm. Accessed July 9, 2015.
- Global Security, “Military Afghanistan Facilities,” <http://www.globalsecurity.org/military/facility/afghanistan.htm>. Accessed Aug 27, 2015.

- Goodson, Larry P. *Afghanistan's Endless War: State Failure, Regional Politics, and the Rise of the Taliban* University of Washington Press, 2012.
- Gordon, Yefim and Alan Dawes. *Sukhoi Su-25 Frogfoot: Close Air Support Aircraft*. London: Airlift, 2004.
- Gorman, Paul F. *U.S. Intelligence and Soviet Armor*. http://www.foia.cia.gov/sites/default/files/document_conversions/89801/DOC_0001066239.pdf. Accessed Aug 4, 2015.
- Grau, Lester W. *Artillery and Counterinsurgency: The Soviet Experience in Afghanistan*. Ft Leavenworth, KS: Center For Army Lessons Learned, 1998.
- . *The Bear Went Over the Mountain: Soviet Combat Tactics in Afghanistan*. Washington, DC: National Defense University Press, 1996.
- . “Breaking Contact without Leaving Chaos: The Soviet Withdrawal from Afghanistan.” *Journal of Slavic Military Studies* 20, no. 2 (2007).
- . “The Soviet–Afghan War: A Superpower Mired in the Mountains.” *Journal of Slavic Military Studies* 17, no. 1 (2004).
- Grau, Lester W., and Dodge Billingsley. *Operation Anaconda: America's First Major Battle in Afghanistan*. Lawrence, KS: University Press of Kansas, 2011.
- Gray, Colin S. “Irregular Warfare: One Nature, Many Characters.” *Strategic Studies*, Winter (2007).
- . *Explorations in Strategy*. Westport CT: Greenwood Publishing Group, 1996.
- Head, William P. *Night Hunters: The AC-130s and their Role in U.S. Airpower*. College Station, TX: Texas A&M University Press, 2014.
- Heydte, Friedrich August, and George Gregory. *Modern Irregular Warfare: In Defense Policy and as a Military Phenomenon*. New York, NY: New Benjamin Franklin House, 1986.
- Hoffman, Frank G. “Complex Irregular Warfare: The Next Revolution in Military Affairs.” *Orbis* 50, no. 3 (2006).
- . *Conflict in the 21st Century: The Rise of Hybrid Wars*. Arlington VA: Potomac Institute for Policy Studies, 2007.
- Holcomb Jr, James F. *Soviet Artillery Utilization*. Ft Leavenworth, KS: Army Combined Arms Center, 1988.

- Hone, Thomas C., and Norman Friedman. "Harnessing New Technologies." In *Transforming America's Military*, edited by Hans Binnendijk. Washington, DC: National Defense University, 2002.
- Hughes, Basil Perronet. *History of the Royal Regiment of Artillery: Between the Wars, 1919–1939*. London: Brassey, 1992.
- Hull, Andrew W., David R. Markov, and Steve Zaloga. *Soviet/Russian Armor and Artillery Design Practices: 1945 to Present*. Detroit, MI: Darlington Productions, 1999.
- Jack, Captain. *Sukhoi Su-17 / Su-20 / Su-22 (Fitter) - Ground Attack / Strike Fighter - History, Specs and Pictures, Military Aircraft*. Military Factory, http://www.militaryfactory.com/aircraft/detail.asp?aircraft_id=192. Accessed July 9, 2015.
- Jackson, Joseph. "Moving Artillery Forward: A Concept for the Fight in Afghanistan." *Small Wars Journal* (2010).
- Jackson, Paul. *Jane's all the World's Aircraft 2002–2003*. Alexandria, VA: Jane's Information Group Limited, 2002.
- Jane, Frederick Thomas, and C. G. Grey. *Jane's All the World's Aircraft 1919, A Reprint of the 1919 Edition of All the World's Aircraft*. New York, NY: ARCO, 1969.
- . *Jane's All the World's Aircraft 1984–85*. New York, NY: Jane's, 1985.
- Kepel, Gilles. *Jihad: The Trail of Political Islam*. Cambridge, MA: Harvard University Press, 2002.
- Kilcullen, David. "Complex Irregular Warfare: The Face of Contemporary Conflict." *The Military Balance* 105, no. 1 (2005).
- Kothari, Chakravanti Rajagopalachari. *Research Methodology: Methods and Techniques*. Daryaganj, New Delhi: New Age International, 2011.
- Krepinevich Jr, Andrew F. *The Army and Vietnam*. Baltimore, MD: JHU Press, 2009.
- Kugler, Richard L. *Operation Anaconda in Afghanistan: A Case Study of Adaptation in Battle*. Washington, DC: National Defense University, 2007.
- Lambeth, Benjamin S. *Air Power Against Terror: America's Conduct of Operation Enduring Freedom*. Arlington, VA: Rand Corporation, 2001.
- Lawrence, Paul R., Davis Dyer, and Tom Lupton. "Renewing American Industry." *R&D Management* 18, no. 1 (1988).

- Leshuk, Leonard . “Stinger Missiles in Afghanistan.” *Europa University Press*, (2008), http://europauniversitypress.co.uk/auth_article416.html. Accessed July 14, 2015.
- Loyn, David. *In Afghanistan: Two Hundred Years of British, Russian and American Occupation*. New York, NY: Macmillan, 2009.
- Mack, Andrew. “Why Big Nations Lose Small Wars: The Politics of Asymmetric Conflict.” *World Politics* 27, no. 02 (1975).
- Maranian, Stephen J. “Field Artillery Fires in the Mountains of Afghanistan.” *Field Artillery Journal* (2008).
- Marine Corps University. *U.S. Army Field Artillery Relevance on the Modern Battlefield*. Quantico, VA: Marine Air-Ground Training and Education Center, 2004.
- Mason, Francis K. *The British Bomber since 1914*. London: Putnam, 1994.
- Mason, Richard Anthony and John William Ransom Taylor. *Aircraft, Strategy, and Operations of the Soviet Air Force*. London: Jane’s, 1986.
- McGarry, Brendan. “Army’s New AH-64E Apache Surprised Enemy in Afghanistan.” *Military* (January 28, 2015). <http://www.military.com/daily-news/2015/01/28/commander-armys-new-ah64e-apache-surprised-enemy-in.html>. Accessed August 31, 2015.
- Mehta, Aron. “Air Force, lawmakers clash over future of A-10 again.” *Military Times*, (April 29, 2014) <http://www.militarytimes.com/article/20140429/NEWS05/304290069/Air-Force-lawmakers-clash-over-future-10-again>. Accessed August 28, 2015.
- Molesworth, George Noble. *Afghanistan 1919: An Account of Operations in the Third Afghan War*. Bombay, NY: Asia Publishing House, 1962.
- Moyes, Philip JR. *Bomber Squadrons of the RAF and their Aircraft*. Detroit, MI: MacDonald, 1964.
- Murray, Williamson R. and Allan R. Millett. *Military Innovation in the Interwar Period*. New York, NY: Cambridge University Press, 1998.
- Myers, Richard B. “National Military Strategy of the United States of America.” *Washington, DC* (2004).
- Nelson, Denny R. “Soviet Air Power: Tactics and Weapons used in Afghanistan.” *Air University Review* 36, no. 2 (1985).
- North Atlantic Treaty Organization, “ISAF’s Mission in Afghanistan 2001–2014,” http://www.nato.int/cps/en/natohq/topics_69366.htm. Accessed August 27, 2015.

- O'Ballance, Edgar. *Afghan Wars 1839–1992: What Britain Gave Up and the Soviet Union Lost*. Herndon, VA: Brassey's, 1993.
- Obama, Barack. *The National Security Strategy of the United States of America*. Washington, DC: Executive Office of The President, 2010.
- Odom, William E. "Soviet Military Doctrine." *Foreign Affairs* 67, no. 2 (1988).
- Office of the Secretary of Defense. *Transformation Study Report: Transforming Military Operational Capabilities*. Washington, DC: Government Printing Office, April 27, 2001.
- Olsen, William J. "Air Power in Low-Intensity Conflict in the Middle East." *Air University Review* 37 (1986).
- O'Rourke, Ronald. *Navy Irregular Warfare and Counterterrorism Operations: Background and Issues for Congress* (CRS Report No. RS22373). Washington, DC: Congressional Research Service, 2015. <https://www.fas.org/sgp/crs/natsec/RS22373.pdf>.
- Parton, Neville. "The Development of Early RAF Doctrine." *Journal of Military History* 72, no. 4 (2008).
- Pomerleau, Mark. "Special Forces: Why use a Cadillac when a Ford Will do." *Defense Systems Knowledge*, 27 May, 2015. <https://defensesystems.com/articles/2015/05/27/ussocom-budget-pressures-isr.aspx>. Accessed June 15, 2015.
- Pratzner Jr, Phillip R. "The Combined Air Operations Center: Getting the Organization Right for Future Coalition Air Operations." Master's thesis, Marin Corps University 2002.
- Quade, Alex' "The Gunship American Special Forces Use To Fight Terror'" *Daily Caller* (2015). <http://dailycaller.com/2015/08/30/federal-court-finds-due-process-violation-in-ny-countys-confiscated-gun-policy/>. Accessed August 30, 2015.
- Record, Jeffrey. "Why the Strong Lose." *Parameters, Winter* (2005).
- Rössler, Eberhard. *The U-Boat: The Evolution and Technical History of German Submarines*. Annapolis, MD: Naval Inst Press, 1981.
- Rubright, Richard W. *The Role and Limitations of Technology in U.S. Counterinsurgency Warfare*. Lincoln, NB : Potomac Books, 2014.
- Secretary of the Air Force (SAF/OS). *AFSOC Weapons and Tactics Program*. Instruction, Air Force Special Operations Command 11–207. Washington, DC: Secretary of the Air Force (SAF/OS), April 8, 2015.

- Shanker, Thom, and Eric Schmitt. "US Plans Shift to Elite Units as it Winds Down in Afghanistan," *New York Times*, February 4, 2012. <http://www.nytimes.com/2012/02/05/world/asia/us-plans-a-shift-to-elite-forces-in-afghanistan.html>. Accessed July 27, 2015.
- Shorrock, Tim. *The Afghanistan War Is Still Raging-but This Time It's being Waged by Contractors*. Washington, DC: The Nation, February 4, 2015. <http://www.thenation.com/article/afghanistan-war-still-raging-time-its-being-waged-contractors/>. Accessed August 13, 2015.
- Starr, Barbara, "Report: Friendly fire killed U.S. soldier," *CNN Washington Bureau*, October 29, 2002. http://www.cnn.com/2002/US/10/29/afghan.friendly.fire/index.html?_s=PM:US. Accessed August 28, 2015.
- Tenet, George. *At the Center of the Storm: My Years at the CIA*. New York, NY: Harper Collins, 2007.
- Thompson, Mark. "U.S. Ends Its War in Afghanistan." *Time Magazine*, December 28, 2014.
- . "V-22 Osprey: A Flying Shame." *TIME Magazine*, February 26, 2007.
- Tomsen, Peter. *The Wars of Afghanistan: Messianic Terrorism, Tribal Conflicts, and the Failures of Great Powers*. New York, NY: Public Affairs, 2013.
- Towle, Philip Anthony. *Pilots and Rebels: The use of Aircraft in Unconventional Warfare 1918–1988*. London: Brassey's, 1989.
- Troup, Tim. "Acquisition Truths from the Trenches." *Defense AT&L Magazine* (May-June 2010).
- Under Secretary of Defense (AT&L), *Defense Science Board Task Force, Fulfillment of Urgent Operational Needs*. Washington, DC: Under Secretary of Defense (AT&L), July 2009. <http://www.acq.osd.mil/dsb/reports/ADA503382.pdf>
- Urban, Mark. "Soviet Operations in Afghanistan: Some Conclusions." *Jane's Soviet Intelligence Review* 2, no. 8 (1990).
- United States Air Force. "Air Force Doctrine Document 2–3, Irregular Warfare." Washington, DC: Department of the Air Force, August 1, 2007.
- . *Air Force Doctrine Document 3–2, Irregular Warfare*. Washington, DC: Department of the Air Force, March 15, 2013.
- . "Air Force Aircraft Fact Sheets." <http://www.af.mil/AboutUs/FactSheets.aspx>. Accessed August 30, 2015.

- United States Army. *Army Doctrine Reference Publication 3–0, Unified Land Operations*. Washington, DC: Department of the Army, May 16, 2012).
- . *Army Doctrinal Reference Publication 3–05, Special Operations*. Washington, DC: Department of the Army, August 31, 2012.
- . *Army Special Operations Forces* (FM 3–05). Washington, DC: Department of the Army, 2014.
- . *Field Artillery Operations and Fire Support* (FM 3–09). Washington, DC: Department of the Army, 2014.
- . *Operations* (FM 3–0). Washington, DC: Department of the Army, 2008.
- . *The Soviet Army Operations and Tactics*, (FM 100–2-1). Washington, DC: Department of the Army, July 16, 1984.
- United States Joint Chiefs of Staff. *Joint Publication 1, Doctrine for the Armed Forces of the United States*. Washington, DC: United States Joint Chiefs of Staff. March 25, 2013.
- . *Joint Publication 3–0, Doctrine for Joint Operations*. Washington, DC: United States Joint Chiefs Staff. August 11, 2011.
- . *Joint Publication 3–05, Special Operations*. Washington, DC: United States Joint Chiefs of Staff. July 16, 2014.
- . *Joint Publication 3–30, Command and Control of Air Operations*. Washington, DC: United States Joint Chiefs of Staff. February 10, 2014.
- . *National Military Strategy of the United States of America: A Strategy for Today; A Vision for Tomorrow*. Washington, DC: Joint Chiefs of Staff, 2004.
- Van Creveld, Martin. *Technology and War: From 2000 BC to the Present*. New York, NY: The Free Press, 1991.
- Vick, Alan J., Adam Grissom, William Rosenau, Beth Grill, and Karl P. Mueller. *Air Power in the New Counterinsurgency Era: The Strategic Importance of USAF Advisory and Assistance Missions*. Arlington, VA: Rand Corporation, 2006.
- Waldman, Matt. *The Sun In The Sky: The Relationship Between Pakistan’s ISI And Afghan Insurgents*. Cambridge MA: Harvard University, 2010.
- Westermann, Edward B. “The Limits of Soviet Airpower: The Failure of Military Coercion in Afghanistan, 1979–89.” *Journal of Conflict Studies* 19, no. 2 (1999).

- Wetzel, Gary. *A-10 Thunderbolt II Units of Operation Enduring Freedom 2002–2007*. Long Island, NY: Osprey Publishing, 2013.
- Wintringham, Tom. *The Story of Weapons and Tactics from Troy to Stalingrad*. Boston MA: Houghton Mifflin company, 1971.
- Wittig, Peter. *United Nations Security Council Report: Resolution 1988 (2011) Concerning the Taliban and Associated Individuals*. November 10, 2013. http://securitycouncilreport.org/atf/cf/%7B65BFCF9B-6D27-4E9C-8CD3-CF6E4FF96FF9%7D/s_2013_656.pdf. Accessed August 2, 2015.
- Wright, Lawrence. *The Looming Tower: Al Qaeda and the Road to 9/11*. New York, NY: Random House, 2006.
- Yusuf, Mohammad, and Mark Adkins. *Afghanistan The Bear Trap: The Defeat of a Superpower*. Havertown, PA: Casemate, 2002.

INITIAL DISTRIBUTION LIST

1. Defense Technical Information Center
Ft. Belvoir, Virginia
2. Dudley Knox Library
Naval Postgraduate School
Monterey, California